where people and their land are safer

A Compendium of Good Practices in Disaster Risk Reduction



SWISS NGO DRR PLATFORM

UNIVERSITÄT BERN

CDE CENTRE FOR DEVELOPMENT AND ENVIRONMENT

WOCAT World Overview of Conservation Approaches and Technologies

where people and their land are safer

A Compendium of Good Practices in Disaster Risk Reduction

Any effort to improve the resilience of the land will reduce the vulnerability of the people.

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World Overview of Conservation Approaches and Technologies

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Foreword

A world without poverty and in peace – this is the vision of the Dispatch on Switzerland's International Cooperation 2017-2020. According to World Bank estimates, over 26 million people per year are pushed into extreme poverty by disasters. Disaster Risk Reduction (DRR) is therefore a key concern for sustainable development and an integral part of humanitarian aid and development cooperation. Nations, communities and individuals are called upon to step up their investments in resilience and address the underlying drivers of disaster risks, including climate change and unsustainable management of land and water resources.

This publication, a co-production between the Centre for Development and Environment (CDE)/ World Overview of Conservation Approaches and Technologies (WOCAT) and the Swiss NGO DRR Platform, showcases important linkages between Sustainable Land Management (SLM) and DRR for reducing present and especially future disasters by preserving and restoring natural resources that ensure livelihoods. It also provides valuable insights into best practices across the globe.

Switzerland is committed to contributing to international development in countries and regions where Swiss expertise and credibility are recognised. As a hazard-prone country, Switzerland has promoted and affirmed the links between SLM and DRR through integrated risk management for over a century. For example, protection forests have been created and their role in reducing risks from avalanches, landslides and floods have been widely acknowledged. Land-use planning has also helped to reduce the number of people affected by disasters. Born of necessity, Switzerland's integrated risk management approach is a unique feature of its international cooperation efforts, helping to reduce disaster risks and build resilience.

The Swiss Agency for Development and Cooperation (SDC) is proud to promote and support the work of WOCAT and Swiss NGO DRR Platform researchers and practitioners to enhance people's resilience, strengthen capacities, promote conscious and sustainable management of natural resources, and take concrete steps towards a greener and safer planet.



Dr. Manuel Sager

Director General
Swiss Agency for Development and Cooperation (SDC)

Disasters from natural hazards seriously affect development – a fact that is both evidenced in the decade-long experiences of Swiss NGOs in disaster prone contexts around the world and recognized in global political frameworks and agreements. While the general public reads about major disasters such as earthquakes or tsunamis, smaller but more frequent disasters are often of equal or even greater concern to the exposed population. Disaster Risk Reduction (DRR) has since long played a central role in many projects run and supported by Swiss NGOs. "Green" measures, e.g. reforestation and soil restoration, have increasingly complemented infrastructural measures such as dams for flood protection. Compared to infrastructure, these green measures achieve an often-greater sustainability by adding to people's livelihood and are particularly well suited to deal with the smaller but much more frequent disasters.

An equally important pillar in the NGO work, driven by this very livelihoods and sustainability perspective, is the support of Sustainable Land Management (SLM) practices. Sustainability here includes not only the economic but also the environmental long-term vision, preserving environmental resources for the generations to come. Through their common entry point of managing the natural environment, SLM and "green" DRR often complement each other naturally, at the same time synergistically reducing risks and conserving land resources.

The present book provides an unprecedented compilation of experiences at the interface of SLM and DRR from development cooperation of Swiss NGOs, offering a comprehensive sample across practices and regions. Scientifically accompanied by the Centre for Development and Environment of the University of Berne, the book however goes beyond a mere collection of case studies, in systematically analyzing and discussing the knowledge from the bundle of practices as a whole.

The reader is thus invited to learn not only from single cases but has at her disposal the quintessence of decades of working the DRR-SLM nexus.

I wish you an inspiring read.



Anja Ebnöther

Head of International Cooperation
CARITAS Switzerland

Preface

This Compendium is derived from a collaboration between the Swiss NGO Disaster Risk Reduction (DRR) Platform and the World Overview of Conservation Approaches and Technologies (WOCAT) global network on Sustainable Land Management (SLM) hosted by the Centre for Development and Environment (CDE) of the University of Bern. Over recent decades, the NGOs of the Swiss NGO DRR Platform have been involved in DRR activities around the globe, many of which are directly or indirectly related to the use and management of land resources, including soils, water, plants and animals. Their long-term experiences and proven good practices are set out here, using the standardised format for the documentation, evaluation and sharing of good practices developed by WOCAT. This publication presents and analyses land-based/ land-related practices and thus highlights the importance and potential of good and sustainable land management as a valid strategy for reducing disaster risk and adapting to a changing climate. In this way, it can contribute to reducing people's vulnerability and strengthening the resilience of communities, households and their land in a world where disasters are increasing, driven by a changing climate and unsustainable land use.

This publication serves as a tool for stakeholders – whether planners, advisors, extension agents, or development consultants – from different sectors (be it DRR, water and sanitation, food security, or agriculture) to include good DRR practices in the planning, design and implementation of development/ humanitarian projects. The aim of the Compendium is therefore to contribute to the up- and outscaling of proven land-based/ land-related practices in DRR by sharing and mainstreaming existing, and emerging, knowledge and experiences.

Part 1 introduces disasters and development (Chapter 1.1) and then existing key concepts in DRR (Chapter 1.2) which are relevant to the understanding of synergies with SLM (Chapter 1.3). It also looks at recent international policy developments relevant for both DRR and SLM (Chapter 1.4). Furthermore, it proposes a simple classification system, which arranges good DRR practices into different groups and an analysis and assessment of the practices (Chapter 2) of which a selection is presented later in Part 2. Part 1 ends with conclusions and policy points (Chapter 3). Part 2 showcases 30 validated DRR practices from 11 countries around the globe, applied by the NGOs of the Swiss NGO DRR Platform.

Part 1



CARITAS, Chad – Newly installed weather stations feed their data into an Early Warning System which alerts the population of drought and other threats to their food security. Through a participatory process with expert consultations it provides advice for adaptation measures.





Part 1: Reducing Disaster Risk by Sustainable Land Management

1. Setting the scene – the problem, concepts and policy

1.1 Disasters – a threat to development

Not all disasters make the headlines: in fact, the majority don't. Nevertheless, our perceptions are shaped by the media. We hear about hurricanes sweeping across regions. Torrential rains and massive floods make for compelling images that are widely broadcast. Regional droughts, hunger and food relief efforts become international news stories. But across the world, and especially in the poorer, developing areas, disasters are commonplace and are a constant threat to families and communities. These, surprisingly perhaps, are the greatest problem globally. Whether it is regular monsoon floods in Bangladesh forcing families to abandon their homes and farms, or landslides burying houses on deforested slopes in Honduras – the risks never go away. Or if it's seasonal droughts in India causing malnutrition of women and children, and in Chad communities running out of food – even seed to plant – when the rains fail, hunger continuously stalks these households. It is those people who are least equipped to cope, who are faced with these extensive shocks. So, while most disasters may be relatively small-scale and affect communities hidden away from the global spotlight, they are both pervasive and frequent. They constitute the greatest disaster problem worldwide. This Compendium shows how many of these are connected to land management. Most importantly we show here how recent experience and new knowledge has opened a window on imaginative solutions that can reduce these disaster risks that undermine development and threaten both livelihoods – and lives.

Disasters are the result of the interaction between a hazard (or multiple hazards), and people and their property – including their land – which are exposed to and affected by the hazard. Disasters therefore can be considered to be a product of the social, political, economic and environmental context of the community or society in which they occur (Swiss NGO DRR Platform 2016, Cardona et al. 2012) making development and disaster risk closely interlinked. This is important to understand in the context of the fact that the frequency and impacts of disasters have increased, globally, over the last few decades (Vinod and López 2015, IPCC 2012b). Between 2005 and 2015, disasters have led to over 700,000 people losing their lives, over 1.4 million people being injured and around 23 million people losing their homes. The total economic loss due to disasters in this time period is estimated at 1.3 trillion US$ (UN 2015a). Floods, storms, heatwaves and other weather-related events have caused 90% of all disasters happening between 1995 and 2015. In the same time period 2.3 billion people were affected by flooding, which accounted for 47% of all these weather-related disasters (UNISDR 2015b).

Evidence indicates that exposure of persons and assets in all countries has increased faster than vulnerability has decreased, thus generating new risks and a steady rise in disaster-related losses, with a significant economic, social, health, cultural and environmental impact in the short, medium and long term, especially at the local and community levels (UN 2015a).

While disasters are happening around the globe, they have the greatest impact on the poor who are exposed, vulnerable and lack the capacity to manage disaster risk (including the recovery processes required). High exposure and vulnerability transform even small-scale events into disasters and may impair poor communities' livelihood and development options (IPCC 2012a). Furthermore, both mortality and economic loss associated with extensive risks in low and middle-income countries are showing an upward trend (UNISDR 2015a). Extensive risk is "the risk of low severity, high-frequency hazardous events and disasters, mainly but not exclusively associated with highly localized hazards" (UNISDR Terminology 2017). The World Bank estimates (based on data from more than 80 countries) that if all disasters caused by natural hazards could be prevented then those living in poverty could fall by 26 million (Halegatte et



left: CARITAS, Chad – Herders bring their livestock to one of the few remaining ponds during a period of drought.

right: HP. Liniger, Tajikistan – A yearly flash flood is carrying high sediment loads from unprotected slopes upstream. The floods pose a substantial risk to housing and the livelihoods of local people.

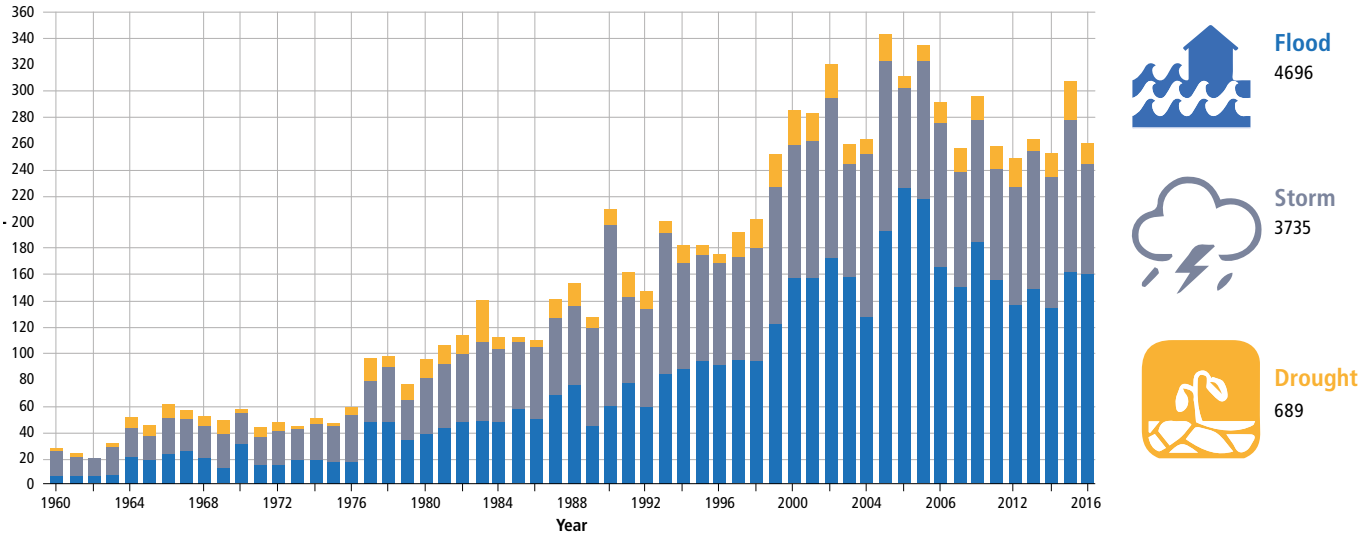


Figure 1: Growing trend in disasters related to floods, storms and droughts between 1960 and 2016.

al. 2017). However, the true cost of extensive risk is unknown and "tends to be underestimated as it is usually absorbed by low-income households and communities and small businesses" (UNISDR 2015a).

Because of the devastating impacts of disasters, it is crucial to analyse the underlying drivers of disaster risk that fuel the trend towards an increase in these phenomena – as shown in Figure 1. There are different natural and human factors that precipitate disasters. Climate change is recognised as one important driver increasing disaster risk, in turn leading to "changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events" (IPCC 2012a) to which communities and societies are exposed.

However, climate change alone cannot explain why more and more people, particularly the poor and vulnerable in developing countries, should bear the brunt of disaster impacts. The International Panel on Climate Change (IPCC 2012a) highlights the increasing exposure of people and their assets as a major cause of long-term increase in economic loss from climate-related disasters – referring to the growing number of people located in areas that are hazard-prone, such as floodplains, steep slopes and coastlines. Importantly, the unsustainable use and management of land (such as deforestation or overgrazing), as well as urbanisation and related land use change, cause the depletion of natural resources and associated degradation of ecosystems which lose their capacity to prevent and mitigate disasters. Coupled with an increased frequency and/ or intensity of climate-related hazards due to climate change, the disaster risk is further heightened.

The role of well-managed, healthy ecosystems and Sustainable Land Management (SLM) in Disaster Risk Reduction (DRR) has been flagged by science and practitioners for over a decade (MEA 2005, Renaud et al. 2013, Monty et al. 2016, Renaud et al. 2016), but it has only recently been given recognition in post-2015 policies on DRR, climate change and sustainable development. Ultimately, investing in climate and disaster resilient communities, and particularly those exposed to small-scale recurring disasters, means supporting people – and the poor in particular – to identify and put into practice appropriate measures to prevent, reduce and deal with disaster risk, without which there cannot be sustainable development for all. This publication sheds light on the





opportunities and mutual co-benefits that linking DRR and SLM can bring to people and their land and thus provide a robust response to one of the main drivers of disaster risk and threats to development.

1.2 Framing definitions and concepts in Disaster Risk Reduction

Hazards and disasters

A **hazard** refers to a phenomenon that may potentially cause a loss or damage whereas a **disaster** refers to a *serious disruption of the functioning of a community or a society, causing human, material, economic and environmental losses and impacts* (UNISDR Terminology 2017, simplified).

Communities and societies are exposed to different types of hazards. A hazard only turns into a disaster if it coincides with people or assets that are exposed, and vulnerable, to the hazard and lack the capacity to deal with the impacts. The United Nations Office for Disaster Risk Reduction (UNISDR Terminology 2017) distinguishes between the following three hazard types:

- **Natural hazards**; predominantly associated with natural phenomena such as earthquakes, volcanic eruptions, extreme rainfall, storms, or dry spells.
- **Socio-natural hazards**; associated with a combination of natural and anthropogenic factors, such as environmental degradation, landslides induced by deforestation or the effects of climate change leading to sea level rise or more frequent and intensive weather- and climate-related events such as droughts or floods.
- **Anthropogenic hazards** or **human-induced hazards**; induced entirely or predominantly by human activities and choices such as pollution or technological accidents.

The publication at hand focuses on natural as well as socio-natural hazards addressed by both DRR and SLM (see Figure 2).

Risks, causal factors, and ways that risk can be reduced

Disaster risk *is the potential loss of life, injury, or destroyed or damaged assets which could occur to a system, society or a community in a specific period of time, determined probabilistically as a function of hazard, exposure, vulnerability and capacity* (UNISDR Terminology 2017).

Anthropogenic hazards		Examples of hazards	Addressed by:
	chemical and technological	chemical spill pollution technical accident explosion	DRR
Socio-natural hazards	hydrological	flood landslide	DRR & SLM
	meteorological and climatological	windstorm, rainstorm cyclones drought wild fire	
	biological	pest epidemics	
Natural hazards	geophysical	tsunamis earthquakes volcanic eruptions mass movement	DRR

Figure 2: Examples of hazards (Source: The authors).

A disaster risk exists, when a hazard, exposure and high vulnerability coincide with low capacity. For example, where floods occur (hazard), villagers who are located in the flow path (exposure), unprotected by any structural and vegetative barriers against the force of water (vulnerability) and with no early warning system and management plan to evacuate (capacity) are at high risk of disaster – with consequent loss of property and, potentially, lives.

The disaster risk is illustrated by the risk equation shown in Figure 3. The first factor of the risk equation, the *hazard*, varies in frequency and magnitude. It is multiplied by *exposure*, which means "the situation of people, infrastructure, housing, the land with its production capacities and other tangible human assets located in hazard-prone areas" (adapted from UNISDR Terminology 2017). The *vulnerability* factor describes the conditions determined by elements such as poverty, age, gender, or education, which "increase the susceptibility of an individual, a community, assets or systems to the impacts of hazards" (UNISDR Terminology 2017). In this publication, it is not only the vulnerability of people, but also the vulnerability of the land, that is given special attention. These three factors are divided by the *capacity* of a community or society to manage and reduce disaster risk and increase the resilience through, for example, human knowledge and skills or social relationships.



left: CBM, Bangladesh – A flood affected family is waiting for rescue.

centre: HP. Liniger, Tajikistan – Deforestation and overgrazing have made the slopes highly vulnerable to heavy precipitation, causing landslides with devastating impacts. Careful restoration of vegetation and better pasture management are contributing to reducing the risk of such events.

right: HEKS/ EPER, A. Boutellier, Ethiopia – In the Borana Zone drought catastrophes have increased in frequency and intensity and their impacts have become more pronounced due to the severe degradation of natural resources in the zone.

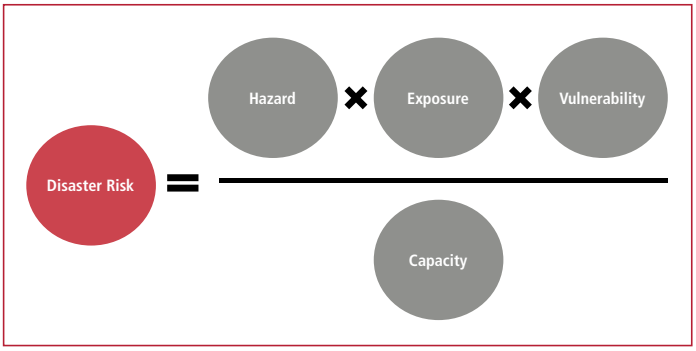


Figure 3: Disaster risk equation in relation to hazard, exposure, vulnerability and capacity (based on UNISDR Terminology 2017).

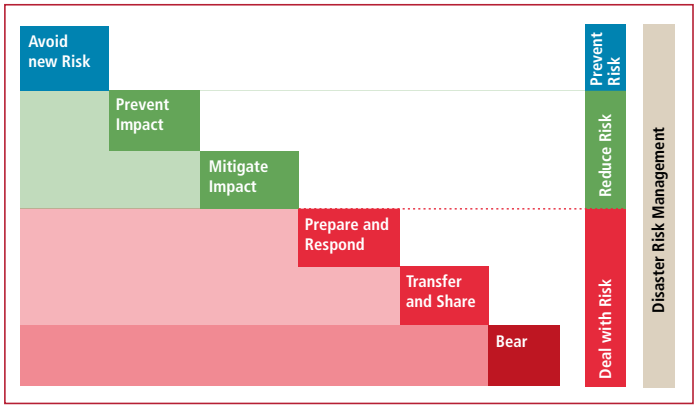


Figure 4: Risk Staircase Model (Source: Swiss NGO DRR Platform based on the Sendai Framework for DRR, UN 2015a).

Following from the definitions above, the aim of **Disaster Risk Reduction (DRR)** is to prevent new, and reduce existing, disaster risk as well as to manage residual risk (UNISDR Terminology 2017, simplified). This can be achieved by addressing any, or a combination of, hazard, exposure, vulnerability and capacity. But risk types and therefore management of risks differ and though there are common denominators, many situations present site specific problems – and solutions differ.

Low-severity high-frequency events ("extensive disaster risks") are often greatly underestimated in terms of global importance; a rare earthquake might pose similar overall risks as a series of yearly flood events – with the latter causing smaller but much more frequent losses. In case of recurrent droughts, the impacts are even more difficult to assess and are less well recognised. DRR measures targeted against extensive disaster risks are at the core of this publication, since in these cases straightforward SLM and DRR practices may substantially reduce disaster risk and contribute to people's, and the land's, resilience.

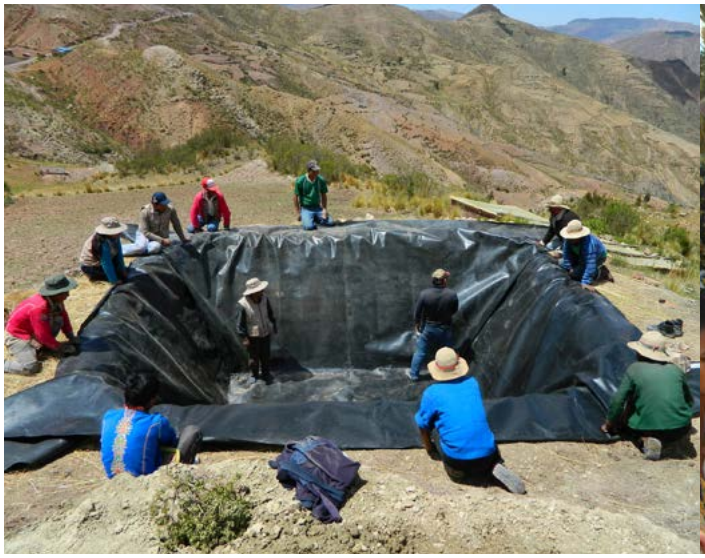
A typology of DRR strategies presented through the "Risk Staircase Model"

The Risk Staircase Model (see Figure 4) provides a clear sequencing of risk management strategies and related measures where prevention is the starting point for managing risk, followed by the mitigation of the impacts of disasters, and on to preparedness for response and risk-sharing mechanisms in order to reduce disaster risk to an acceptable, manageable level.

Risk prevention refers to regulation and practices which **avoid the creation of new risks**. Examples are land use planning with the prohibition of settlements and other investments in disaster prone areas, laws and regulations to avoid the overuse of natural resources, or protection of natural resources and infrastructure by communities.

Risk reduction entails measures of disaster **prevention** with the aim of completely avoiding the potential adverse impacts of hazardous events and **mitigation measures** which attempt to limit and reduce the adverse impacts. These two categories and interventions often overlap. Examples are single practices such as reforestation but also integrated watershed management approaches, including, for example, structural measures such as dams and terraces or vegetative measures such as agroforestry or grass strips in strategic sites within the watershed.

Residual risk is the risk that remains even if effective disaster risk prevention and reduction measures are in place and needs to be **dealt with** through measures of **preparedness and response** as well as **risk transfer and sharing**. Preparedness and response refer to the capacity of people and institutions to effectively anticipate hazards and/ or respond to disasters by actions taken during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic needs of the people affected. The successful implementation of measures such as early warning systems, contingency planning and emergency response mechanisms requires thoughtful planning a considerable time before an actual event strikes. **Transfer and share** is the process of shifting the financial or other





impacts of particular hazards from one party to another. Insurance is a well-known form of risk transfer. Another form of risk transfer comprises solidarity mechanisms at community level (e.g. emergency funds in-cash or in-kind) with reciprocal expectations of mutual aid that help people to share and bear impacts of a disaster.

A zero-risk society is not possible, so the objective of DRR is to keep the remaining risk at a level that is acceptable; one which can be borne by the people, communities and societies given existing social, economic, political, cultural and environmental conditions.

The Risk Staircase Model is based on the **Integrated Risk Management (IRM)** approach, a fundamental guiding concept for the Swiss DRR community to identify and plan DRR measures. Under the IRM approach, DRR links humanitarian concerns with development issues and these are expressed in appropriate DRR interventions and projects. The objective of IRM is to ensure that risks to people and their livelihoods are kept as low as possible – or at least within acceptable bounds. By asking three fundamental questions: *What can happen? What is acceptable? What needs to be done?* the IRM approach aims at identifying the most pressing risks, prioritizing them and taking effective and efficient measures for risk reduction. The IRM approach recognises that successful DRR interventions require measures to be taken before, during and after a disaster event, ranging, as noted above, from prevention, mitigation, preparedness and response to risk transfer measures as presented in the risk staircase. Moreover, the collaboration between different actors such as civil protection, humanitarian actors, development planers, and environmentalists from different sectors and institutions is key.

Good risk management starts with a **risk assessment** – identifying, analysing and assessing disaster risk together with affected stakeholders. Different methods and tools are available to carry out the risk analysis/ assessment. This should be followed by participatory action planning including different practices based on available resources. Annex 2 provides an overview of selected tools and methods used by the NGOs of the Swiss NGO DRR Platform to carry out risk assessments.

The relationship between Disaster Risk Reduction, Climate Change Adaptation and ecosystems

The majority of natural hazards such as floods, storms or droughts are caused by hydro-meteorological phenomena and are influenced by climate change, which is increasing their frequency and intensity (Vinod and López 2015, IPCC 2012a). Consequently, DRR and Climate Change Adaptation (CCA) overlap to a large extent: they share a common understanding of the components of risk and how to reduce people's exposure and vulnerability to these. Nevertheless, as shown in Figure 5, each has other specific concerns also: thus, CCA additionally focuses on the effects of gradual climate changes and related long-term adjustments required to deal with these changes, while DRR also addresses other hazards such as earthquakes and volcanic eruptions (Turnbull et al. 2013, Mitchel and van Aalst 2008, Venton and La Trobe 2008).

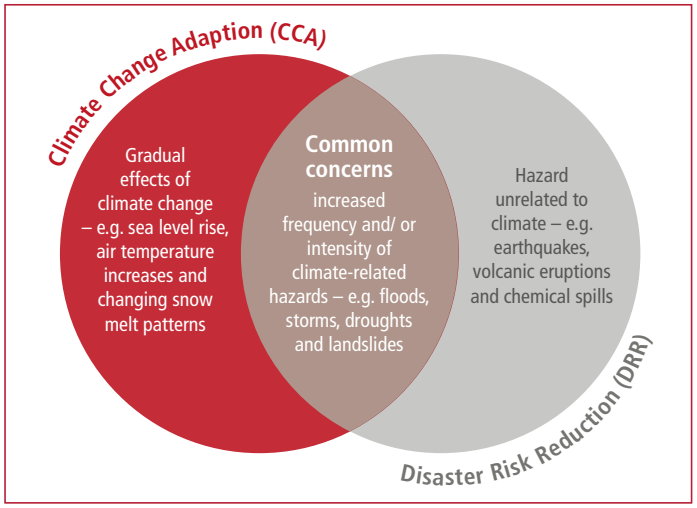


Figure 5: Common concerns of CCA and DRR (Source: Turnbull et al. 2013).

The role of ecosystems in reducing disaster risk and adapting to a changing climate is increasingly recognised (Lo 2016, Monty et al. 2016, Doswald and Estrella 2015). The Sendai Framework for Disaster Risk Reduction (see Chapter 1.4) recognizes the role of ecosystems and environment as a cross-cutting issue in DRR (PEDRR 2016). The most commonly used concept for describing DRR approaches focusing on ecosystem management is **ecosystem-based DRR (Eco-DRR)**. Eco-DRR is defined as "the sustainable management, conservation and restoration of ecosystems to provide ser-



left: HELVETAS Swiss Intercooperation, Bolivia – Joint action: Farmer community members installing the geo-membrane of a water retention pond.

centre: HELVETAS Swiss Intercooperation, Bangladesh – Women of a community-based organisation in a participatory analysis of their disaster-related problems.

right: Swiss Red Cross, Honduras – Sensitizing school children on environment, climate change, natural hazards and how they are interlinked can have a multiplying effect as children discuss the topics at home with their parents and siblings.

vices that reduce disaster risk by mitigating hazards and by increasing livelihood resilience" (Doswald and Estrella 2015, PEDRR 2013).

Eco-DRR is an example of the attention to nature-based solutions (Cohen-Shacham et al. 2016) that have emerged in recent years in an attempt to address societal challenges such as climate change, food security or disasters. Other similar approaches relevant to risk reduction include Ecosystem-based Adaptation (EbA) used in CCA (see CBD 2009), green/ natural infrastructure, and ecological engineering. Ultimately, all these approaches seek to work with nature to find solutions to sustainable development.

The Partnership for Environment and Disaster Risk Reduction (PEDRR) (http://pedrr.org) was established in 2008 and is a global alliance of UN agencies, NGOs and specialist institutes. It seeks to promote and scale-up implementation of Eco-DRR and ensure it is mainstreamed in development planning at global, national and local levels, in line with the Sendai Framework for Disaster Risk Reduction.

According to PEDRR (2010) well-managed ecosystems contribute to DRR in two ways:

1. They serve as **natural protective barriers or buffers** that reduce physical exposure to natural hazards. For example, healthy coastal ecosystems help to protect the coastline, well-maintained riverine ecosystems such as floodplains protect against floods, and robust forests reduce the risk of landslides (Renaud et al. 2016).

2. They have an important role in **reducing social and economic vulnerability** to hazards by sustaining livelihoods and providing goods such as food, wood and fibre.

Today an estimated 60 per cent of the world's natural ecosystems are degraded, many beyond the point of recovery. Having lost their capacity to provide vital ecosystem services for human well-being, these ecosystems can magnify hazard levels, increase vulnerability and challenge resilience (UNISDR 2015a). Against this backdrop an Eco-DRR approach closely related to the broader concept of Sustainable Land Management (SLM), as shown in the next chapter, increases in importance.

1.3 Common goals and challenges in Disaster Risk Reduction and Sustainable Land Management

How SLM contributes to DRR

Unsustainable land use and management (e.g. deforestation, overgrazing, unsuitable agricultural practices) not only leads to land degradation, but thereby increases the vulnerability of the land and people to hazards, for example during rainstorms when the land is not able to cope with the rainfall, surface runoff is increased, in turn damaging land and infrastructure and leading to loss of production. Furthermore, unsustainable land use and management can also be a driver of specific hazards such as floods and landslides. Both, Eco-DRR and SLM pursue the common goal of addressing degraded and vulnerable land through actions that ensure healthy and functional ecosystems.

Sustainable Land Management *is the use of land resources, including soils, water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and ensuring their environmental functions* (Liniger et al. 2011, Liniger and Critchley 2007).

Sustainable Land Management (SLM) aims, depending on the situation, to (WOCAT 2017; Figure 6):
- prevent land degradation (maintain natural resources; their environmental and productive functions),
- reduce land degradation (reduce ongoing degradation and/ or halt further degradation),
- restore/ rehabilitate severely degraded land (remedial action when original use is no longer possible), and/ or
- adapt to land degradation ("accept" severe degradation and adapt land management accordingly).

The general term *land degradation* describes "the degradation of land resources, including soils, water, vegetation and animals" (WOCAT 2017). WOCAT distinguishes between the following six types of land degradation (see also Table 3 on page 29):
- Soil erosion by water, e.g. gully erosion, coastal erosion, mass movements/ landslides.
- Soil erosion by wind, e.g. loss of topsoil, off-site degradation effects.
- Chemical soil deterioration, e.g. fertility decline and reduced soil organic matter content, salinization.
- Physical soil deterioration, e.g. compaction, soil sealing.







Figure 6: Ranglands in Kenya situated less than 1 km from each other with different stages of land degradation, requiring different interventions: prevention of land degradation, reduction of land degradation and rehabilitation of land (Source: HP. Liniger).

- Biological deterioration, e.g. reduction of vegetation cover, increase of pests.
- Water degradation, e.g. change in quantity of surface water, change in aquifer level.

A degraded ecosystem can suffer from different types of land degradation simultaneously; e.g. degraded grassland can suffer from reduction of vegetation cover, loss of topsoil and compaction. It becomes more vulnerable to risks.

SLM ensures, enhances and restores ecosystem services as it can amongst other positive impacts increase soil cover, improve infiltration of water and storage in the soil, regulate excessive water, ensure sufficient and clean water supplies, and underpin production of food or fodder. According to the United Nations Convention to Combat Desertification (UNCCD) (Sanz et al. 2017) "SLM represents a holistic approach to preserving ecosystem services in long-term productive ecosystems by integrating biophysical, socio-cultural and economic needs and values". Furthermore the UNCCD acknowledges that SLM offers land-based solutions to address desertification, land degradation, drought, as well as Climate Change Adaptation and Mitigation (Sanchez et al. 2017).

The recently articulated concept of "Land Degradation Neutrality" (LDN), defined at the UNCCD Conference of the Parties (COP) in 2015, highlights the role of SLM in reducing land degradation (see Figure 7).

Land Degradation Neutrality *is a state whereby the amount and quality of land resources necessary to support ecosystem functions and services and enhance food security remain stable or increase within specified temporal and spatial scales and ecosystems* (Orr et al. 2017).

Inherent in the LDN are the following three objectives (Orr et al. 2017):

1. Maintain or improve the sustainable delivery of ecosystem services.
2. Maintain or improve productivity in order to enhance food security.
3. Increase the resilience of the land and populations dependent on the land.

Objective three confirms the interdependence between the resilience of land and the resilience of people.

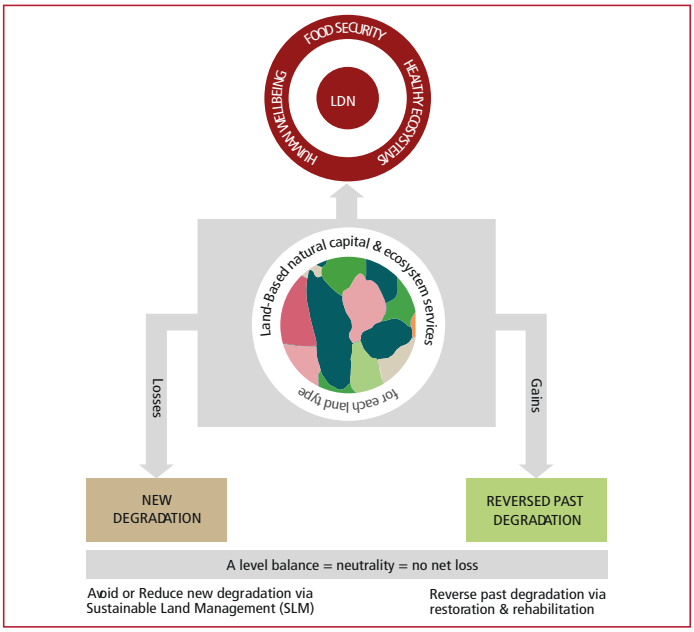


Figure 7: Key elements of the scientific conceptual framework for LDN (Source: adapted from Orr et al. 2017).



left: Swiss Red Cross, Ghana – Community mapping exercise.

centre: HELVETAS Swiss Intercooperation, Afghanistan – Leaders of Village Development Committees (VDC) in a participatory planning session for their livelihoods-related DRR action planning.

right: CBM, Bangladesh – Disaster preparedness training.

Box 1: DRR and SLM: Specific Focuses and Similarities

DRR (as per experience of the Swiss NGO DRR Platform)	**SLM** (as per understanding of WOCAT)
Specific Focuses	
• Focus on local actors and their assets	• Focus on land resources, land uses and land users
• Focus on a range of hazards from purely natural (e.g. earthquakes) to man-made (e.g. water pollution)	• Focus on natural hazards which have an impact on the land and on land-related human activities
• Ranges from rural and urban contexts	• Focus mainly on rural contexts
• Focus on a broad range of disaster impacts related to any type of community assets	• Focus on disaster impacts/ losses related to land and its productivity
• Scale refers to social, administrative borders of key actors (households, communities, municipalities etc.)	• Scale refers to natural borders (ecosystems, watershed, landscape) and human borders e.g. small-scale, mixed, commercial
• Focus on a wide range of sectors - humanitarian as well as development oriented	• Focus on sectors related to environment and land uses, mainly development related
• Measures cover a broad spectrum including preparedness and risk transfer to deal with disasters	• Measures focus on improved land management incl. measures for disaster prevention and mitigation
• No systematic documentation	• Worldwide documentation through WOCAT

Similarities/ Synergies

- Consideration of environmental/ natural assets as crucial capital for local communities
- Promotion of a combination of infrastructural/ physical and intangible measures (DRR: soft & hard interventions, SLM: Technologies and Approaches)
- Promotion of preventative action as a priority ahead of reaction/rehabilitation
- Focus on local resources in terms of material (soil, wood, stones etc.), financial resources, simple techniques for implementation, operation and maintenance
- Focus on capacity of local people as actors rather than simply 'beneficiaries', strengthening of local/ indigenous know-how through documentation and technical improvement
- Application of a do-no harm approach with a long term vision
- Promotion of measures, which give local stakeholders 'ownership'
- Collaboration (households/ land users, local government, civil society, private sector etc.) is crucial to success
- Increasing consideration of interfaces related to CCA, Climate Change Mitigation (CCM), Climate-Smart Agriculture (CSA) and others in order to make use of synergies
- Promotion of DRR and SLM measures as investment (to avoid future loss) instead of a cost
- Rich practical experience of good practices, highly relevant for local actors on the ground
- Advocacy for an action-oriented and people-centred implementation of (international) frameworks at the local level
- Concrete practical measures with the final goal of contributing to resilience building for sustainable development

Resilient people and resilient land – the need for both

Resilience *is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions* (UNISDR Terminology 2017).

Strengthening the resilience of people is an ultimate goal of all DRR activities. DRR seeks to contribute to increasing the resilience of communities and households by strengthening a set of capacities related to resilience. These capacities can be divided into absorptive, anticipatory and adaptive capacities, which are interlinked:

- **Adaptive capacity;** the ability to adapt to multiple impacts of hazards and also to learn and adjust after a disaster.
- **Anticipatory capacity;** the ability to anticipate and reduce the impact of hazards through preparedness and planning.
- **Absorptive capacity;** the ability to absorb and cope with the impacts of hazards.





A social system with these three capacities is less likely to be undermined by impacts of hazards, so wellbeing can be ensured and human development can continue to progress in locations exposed to hazards and disasters (Bahadur et al. 2015).

In summary, SLM aims specifically at improving the resilience of the land and through this, contributes to people's resilience. SLM can increase the absorptive capacity of the land – the land is able to cope with hazards (such as a flood or a drought) and changes (such as temperature increase) as the practice implemented for instance protects the soil, increases water infiltration and thereby reduces damaging surface water runoff, soil erosion and improves the soil/water relationship. Land users who become attuned to using SLM quickly understand the concept of resilience – and are key actors in DRR at the local level.

1.4 The Policy Level: Creating an international enabling environment

The year 2015 marked a milestone on the pathway to achieve sustainable development with the adoption of three major global frameworks. The first of these agreements, adopted in March 2015 in Sendai, Japan was the Sendai Framework for Disaster Risk Reduction (SFDRR), which serves as the global framework to guide Disaster Risk Reduction efforts from 2015 to 2030. In October 2015, the UN General Assembly adopted the Agenda 2030 for Sustainable Development with its 17 Sustainable Development Goals (SDGs) and 169 targets, which guide national and local development agendas until 2030. Heads of States committed to eradicate poverty and hunger and achieve sustainable development in its three dimensions: economic, social and environmental. Finally, in December 2015, the Paris Agreement on Climate Change was adopted and resulted in firmer commitments to reducing carbon emissions globally as well as in articulated principles for Climate Change Adaptation.

All three global policy agreements mentioned above clearly recognise the role that healthy ecosystems underpinned by SLM play in safeguarding development gains and in building resilience against disasters and climate change (PEDRR 2016).

In the **Sendai Framework for Disaster Risk Reduction (SFDRR)**, with its global targets and priorities of action, ecosystems and the environment feature as cross-cutting issues within Disaster Risk Reduction. On the one hand, ecosystem degradation, such as the unsustainable use of natural resources or poor land management, are understood as underlying drivers of disaster risk; on the other hand the environmental impacts of disasters are recognised. Countries are explicitly encouraged to strengthen the sustainable use and management of ecosystems for building resilience to disasters. Ecosystems, environment and, specifically, land use planning need to be taken into account in undertaking risk assessments (Priority Action 1), in risk governance (Priority Action 2) and investing in resilience (Priority Action 3). The SFDRR highlights that communities and households are particularly affected by recurring small-scale and slow-onset disasters and stresses and that there has to be a broader and more people-centred preventative approach to disaster risk (UN 2015a).

One main pillar of the **Sustainable Development Goals (SDGs)** is the protection of the planet from further degradation through sustainable natural resource management, sustainable consumption and production, and by taking action on climate change (UN 2015b, https://sustainabledevelopment.un.org, www.wocat.net). Major interlinkages between ecosystems, DRR and Climate Change Adaptation are supported in the following SDGs through which the promotion of good practices in DRR, related to ecosystems and land use and management, can particularly be supported:



Goal 2 (End hunger, achieve food security and improved nutrition and promote sustainable agriculture) promotes the implementation of resilient agricultural practices that help maintain ecosystems and strengthen capacity for adaptation to climate change, extreme weather, drought and flooding and that progressively improve land and soil quality (Target 2.4).



Goal 6 (Ensure availability and sustainable management of water and sanitation for all) mentions the importance of integrated water resources management at all levels (Target 6.5) as well as the protection and restoration of water-related ecosystems (Target 6.6).



Goal 11 (Make cities and human settlements inclusive, safe, resilient and sustainable) emphasises the importance of protecting and safeguarding the natural environment (Target 11.4).



left: HEKS/EPER, R. Rohner, Senegal – People in the region of Thiès are confronted with an increase in rain variability, where precipitation events have become less frequent but more intense. To reduce water erosion and slow down surface runoff the community builds small stone walls.

centre: Tearfund, Uganda – Measures for source protection.

right: HEKS/ EPER, R. Rohner, Ethiopia – Communities in Borana have established stone bunds to retain water with the result that vegetation cover has reappeared after the rainy season.



Goal 13 (Take urgent action to combat climate change and its impacts) strives to strengthen resilience and adaptive capacity to climate-related hazards and natural disasters (Target 13.1) as well as capacity building on Climate Change Mitigation, adaptation, impact reduction and early warning (Target 13.3).



Goal 14 (Conserve and sustainably use the oceans, seas and marine resources for sustainable development) promotes the sustainable management and protection of marine and costal ecosystems (Target 14.2).



Goal 15 (Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation, and halt biodiversity loss) strives to ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services (Target 15.1) as well as to combat desertification, restore degraded land and soil – including land affected by desertification, drought and floods – and strive to achieve a land degradation-neutral world (Target 15.3).

The **Paris Agreement** recognises the need for protection of ecosystems and biodiversity in both Climate Change Mitigation and Adaption actions (UNFCCC 2015). It specifically promotes the principles of adaptation that take ecosystems into account, and simultaneously it calls for integration of adaptation into relevant environmental policies and actions. In Article 7 the Agreement calls for: "building the resilience of socioeconomic and ecological systems, including through economic diversification and sustainable management of natural resources". Furthermore, under Article 8: "Parties are committed to recognize the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events, and the role of sustainable development in reducing the risk of loss and damage". The Paris Agreement and with it the strong commitment of governments to adapt to and combat climate change is an opportunity to promote land-based actions, especially in the context of Nationally Determined Contributions (NDCs) (Sanz et al. 2017).



2. Analysis of Disaster Risk Reduction practices

2.1 Selection and documentation of DRR practices

The Swiss NGO DRR Platform (www.drrplatform.org) partnered with the World Overview of Conservation Approaches and Technologies (WOCAT) (www.wocat.net) to document and analyse good practices in DRR. The DRR Platform took advantage of the fact that WOCAT is an internationally established network with a set of recognised tools and methods for standardised documentation and evaluation of SLM practices (see Box 3: WOCAT Global Database on SLM). It was found that this methodology could be readily applied to DRR and would offer an opportunity to share and disseminate knowledge and good examples among practitioners and decision-makers.

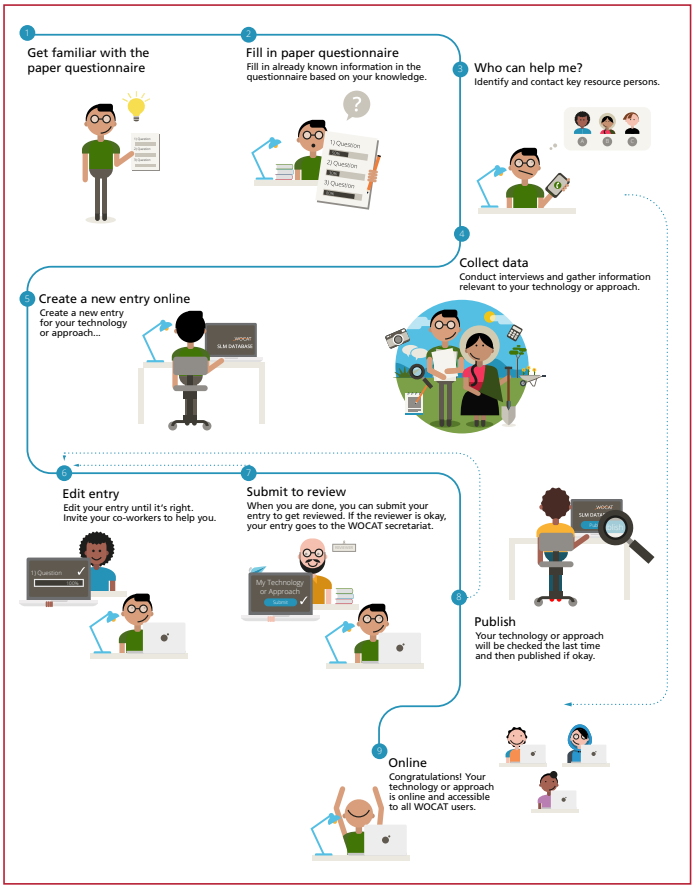


Figure 8: Process of data collection and review of WOCAT (www.wocat.net).

The selection of the practices presented in Part 2 of this publication was based on the following criteria. They should:

- represent proven showcases of successful DRR interventions which the NGOs of the Swiss NGO DRR Platform have been promoting over a number of years;
- focus on some of the most important DRR issues affecting, particularly, rural households and communities;
- address different types of hazards and disasters;
- cover a wide range of different land-based/ land-related DRR practices, addressing different themes and issues in the context of DRR and SLM; and
- cover different continents, countries and contexts where the NGOs of the Swiss NGO DRR Platform are active and experienced.

The DRR practices showcased were documented using the WOCAT Questionnaires on SLM Technologies and Approaches (see Box 2 for an explanation of "Technology" and "Approach") - and an additional tailor-made DRR questionnaire. The data were compiled by NGO staff in different countries and entered into the Global WOCAT Database on SLM (see Box 3). Then, the data were reviewed and quality assured in an interactive process between the compilers, reviewers from the Swiss NGO DRR Platform and, finally, the WOCAT Secretariat (see Figure 8 for an illustration of the WOCAT data collection and review process).

Box 2: SLM Technology and SLM Approach

An **SLM Technology** *is a physical practice on the land that controls land degradation, enhances productivity, and/ or other ecosystem services. A Technology consists of one or more measures, namely agronomic, vegetative, structural, and management measures* (WOCAT 2017).

An **SLM Approach** *defines the ways and means used to implement one or more SLM Technologies. It includes technical and material support, involvement and roles of different stakeholders, etc. An Approach can refer to a project/ programme or to activities initiated by land users themselves* (WOCAT 2017).

In Part 2 a sub-set of 30 from the 44 documented DRR practices is presented while all 44 are taken into account in the analysis. Those examples not included in this publication are published in an on-line pdf version. In most of the cases presented in Part 2, both the Technology/ Technologies as well as the/ their related Approach were documented (see Overview on page 50-52) in order to provide a comprehensive picture of both the physical intervention(s) on the



left: HP. Liniger, Haiti – The lowland of a small watershed in Haiti with a large riverbed created during cyclone Matthew in 2016. Before the cyclone the riverbed was less than one tenth of the size. Riverbanks are stabilised by gabions in order to prevent further destruction of fertile cropland along the river.

right: Plan International, Myanmar – Children planting trees.

ground as well as the stakeholders, their organisation, roles and methods used to implement one or more Technologies. In certain cases the Approach is stand-alone and no corresponding Technology was documented.

It is important to note that the Technologies and Approaches analysed in the following sections do not represent a random sample from which statistical significance can be drawn. What the analysis does provide, however, is an insight into common denominators of what are, in most cases, successful examples. Based on the insights gained from the analysis of the full set, a number of lessons learnt and policy points are derived which are relevant in the context of linking DRR and SLM. However, these are not exhaustive and could – and probably should – be further developed by documenting and assessing more examples of DRR. This exercise should be seen as the start of a process.

Box 3: WOCAT Global Database on SLM

The Global Database on SLM of the World Overview of Conservation Approaches and Technologies (WOCAT) (https://qcat.wocat.net) provides free access to the standardised documentation of field-tested SLM data including SLM practices and maps from different locations in the world, and offers practitioners the opportunity to share their knowledge and learn from each other's solutions.

The Database currently contains more than 1500 SLM practices from over 120 countries worldwide. This constitutes the primary recommended database by the United Nations Convention to Combat Desertification (UNCCD) for the reporting of Good Practices in SLM by the UNCCD Parties.



2.2 Classification of DRR practices

The 24 documented Technologies are presented in two ways. First, through the DRR lens, together with the related/ stand-alone 20 Approaches (Table 1). Second, through the SLM lens: here the Technologies are classified into seven Technology groups (Table 2).

The DRR lens

In Table 1 each Technology is assigned to one or two types of **DRR measures**, following the logic of the **Risk Staircase Model** as presented in Chapter 1.2. The following three categories exist: "**Prevent and reduce risk**"; "**Reduce risk**"; and "**Deal with the risk**". Even though certain Technologies may be risk prevention measures, it depends on the magnitude of the hazard whether a Technology can entirely prevent - or only reduce a hazard. For example, reforestation in a catchment area may be aimed at preventing floods; however, if the magnitude of the causative factors (i.e. the intensity/ quantity/ spread of rainfall) is very high, the forest may only be able to reduce the flood but not prevent it. Therefore, the risk prevention Technologies have been assigned to both categories "Prevent" and "Reduce". The same logic is followed in the presentation of the 30 practices in Part 2 of the publication.

Table 1 also shows which hazard(s) is/ are addressed by the Technology/ Approach. The following hazards were identified by the compilers of the practices: (a) Flood; (b) Rainstorm; (c) Drought; (d) Dry spell; (e) Wildfire; and (f) Landslide. Cyclones are included under 'Rainstorm'. Biological hazards such as pests, diseases or invasive species did not happen to be featured in any of the examples and are therefore not listed, even though these are relevant in both DRR and SLM. After the hazard(s) the main risk reduction function of the Technology is described briefly. In a further column, a simple division into three classes is made: Technologies that most resemble SLM (Category 1), those that are 'conventional' DRR (Category 3), and those that can be considered in the middle (Category 2). This arrangement should yield in a better understanding of which community, SLM or DRR, the Technologies originate/ in which type of projects they are generally used.

Additionally, for both Technologies and Approaches it is defined whether the practice is **implemented individually** – by a person/ household - or whether the **involvement of the community** is required for implementation and/ or





sustained function. Even though a bench terrace or a soil and water channel may be implemented on individual land, they are most effective if they are constructed over a larger, contiguous area, which usually includes the plots of several land users. Whatever the situation, community involvement/ acceptance of a Technology is crucial for its functioning at a watershed/ landscape level. The example 'Protection of microbasins through reforestation' from Honduras shows that the intervention only functions if the whole watershed community works together. Another example from Tajikistan is 'Water points for livestock in daily pastures' which are established jointly by the members of the 'Pasture User Union'.

The SLM lens

In Table 2 the Technologies are first assigned to three overarching clusters, namely: **land-based, land and water-based** and **land-related** Technologies. The land and water-based Technologies are implemented on the land or on/ in the water respectively and are directly associated with land use and management. The land-related Technologies are only indirectly associated with land use and management as either the Technology is constructed on land (Technology group 'Adapted infrastructure'), provides inputs for land use and management (Technology group 'Adapted seeds/ crops') or uses products from the land (Technology group 'Food/ fodder reserves'). This grouping was found to be valuable as it is mainly the land-based Technologies, which are common in SLM. Furthermore, in the following analysis, some differences between the land-based and land-related Technologies are identified.

In a second step, the Technologies are assigned to seven different DRR Technology groups which are based on (a) the function of the Technologies and (b) the four measure(s) (agronomic, vegetative, structural, management) comprising the Technologies. The following seven groups are distinguished as follows:

1. Reforestation/ vegetation cover aiming at:
- Increasing infiltration
- Increasing soil water
- Recharging groundwater
- Reducing evaporation
- Improving microclimate
- Reducing runoff and erosion
- Reducing runoff velocity
- Reducing wind velocity

2. Cross-flow barriers including microcatchments aiming at:
- Increasing infiltration
- Water harvesting (micro)
- Increasing soil water
- Recharging groundwater
- Reducing runoff and erosion
- Reducing runoff velocity

3. Cross-flow drainage and redirection including macrocatchments and floodwater harvesting aiming at:
- Water harvesting (macro, flood)
- Reducing runoff and erosion (gully)
- Reducing runoff velocity
- Discharging/ redirecting safely
- Increasing infiltration
- Controlling flow velocity and reducing peak flows

4. Productive infrastructure aiming at:
- Being dynamic/ flexible/ adapting in/ to water
- Reducing risk of production loss

5. Adapted infrastructure aiming at:
- Moving people and assets out of the danger zone
- Securing safe water

6. Adapted seeds/crops aiming at:
- Reducing the risk of harvest failure

7. Food/ fodder reserves aiming at:
- Reducing the risk of famine/ food/ fodder shortage

It must be recollected that the list of Technology groups was put together based on the sample of 24 Technologies documented and is not exhaustive. Additional Technology groups, not included in this publication but relevant to both DRR and SLM, are for instance pest/ disease management or wetland protection/ management. The analysis in the following Chapter is partly carried out in relation to the seven Technology groups, enabling similarities and differences to be identified.

Table 2 further shows selected information on the natural environment including climatic zone, main land use types where the Technology is applied, the degradation types addressed as well as, again, the hazards.



left: Tearfund, Uganda – Model garden.

centre: Terre des hommes, Bangladesh – Keyhole garden.

right: HELVETAS Swiss Intercooperation, Bangladesh – Floating gardens at the end of the monsoon season with seedlings and vegetables for harvesting or transplantation to the fields.

Table 1: Classification of the Technologies and Approaches through the DRR lens

Type of DRR measure	Technology	Hazard(s)	Main risk reduction function of Technology	SLM (1), SLM - DRR (2), DRR (3)	Individual or community	Approach	Individual or community
PREVENT AND REDUCE	Water points for livestock in daily pastures	flood; rainstorm; drought; landslide	• Provides water during dry periods when rivers are dried up • In combination with rotational grazing reduce overgrazing and trampling and therewith soil erosion and landslides	2	c	Pasture User Union (PUU)	c
	Artifical reef	rainstorm	• Ensure safe fishing • Increase fish population near coast	3	c	Social Entreprise (SE)	c
	Protection of water resources	flood; drought; dry spell; wildfire; landslide	• Provide safe drinking water • Preserve water resources • Reduce water contamination • Guarantee water during times of low flow	1	c	Local consultation for action on hillsides to protect water resources	c
	Living barriers	flood; rainstorm; wildfire; landslide	• Reduce surface water runoff and improve infiltration • Reduce soil erosion • Prevent landslides • Protect infrastructure	2	i	Participatory slope stabilisation	i
	Drainage fascines	flood; rainstorm; landslide	• Reduce surface water runoff • Reduce soil erosion • Prevent landslides	3	c		
	V-shaped catchment fence using Izote (Yucca sp.)	flood; rainstorm; wildfire; landslide	• Reduce soil erosion • Prevent landslides • Create area for crop production • Protect houses	2	i		
	Bench terracing	flood; rainstorm	• Reduce erosion • Increase water infiltration • Off-site benefits	1	c		
	Farming God's way	rainstorm; drought; dry spell	• Increase soil cover through minimum tillage and mulching • Increase soil fertility with application of organic manure	1	i		
	Soil and water conservation channels	flood; rainstorm	• Reduce soil erosion and surface runoff	2	c		
	Farmer Managed Natural Regeneration (FMNR)	flood; rainstorm; drought; dry spell; landslide	• Increase soil fertility • Increase water availability • Tree and grass cover	1	i/ c	FMNR implementation approach	i
	Protection of microbasins through reforestation	flood; rainstorm; wildfire; landslide	• Ensure water availability • Reduce soil erosion	1	c	Legal protection of microbasins through decrees*	c
REDUCE	Protection of water infrastructure against disaster risks	flood; rainstorm; landslide	• Safe drinking water • Availability of drinking water	1	c	* links to "Legal protection of microbasins through decrees"	
	Rock catchment	rainstorm; drought	• Availability of water	2	c	Partnership with beneficiary communities in project implementation	c
	Disability-inclusive, flood resilient cluster village	flood; drought	• Safe housing • Food security • Reduce erosion	3	c	Disability-inclusive Disaster Risk Reduction	c
	Sub-surface water harvesting for more efficient use of water resources	flood; drought	• Water harvesting to ensure water availability	2	c	Water Use Management Plan (WUMP)	c
	Terra Preta raised garden beds	flood; rainstorm; drought; dry spell	• Enable crop production (where previously no crops were cultivated) • Reduce soil erosion • Enhance soil fertility • Increase food self-sufficiency and malnutrition	1	i	Approach at household level for Terra Preta home gardens	i
		flood; drought				Collection, selection, breeding and dissemination of locally adapted rice varieties at the Local Agricultural Research and Extension Centre LAREC	c
	Keyhole garden	flood; rainstorm; drought	• Enhance dietary diversity • Increase duration of gardening period • Protect garden from flooding • Withstand salt water tidal intrusion	2	i	Peer to peer pass-on approach with women	i
	Floating garden	flood; rainstorm	• Ensure production during floods • Food and nutrition security	2	i		
	Pond Sand Filter (PSF)	flood; drought	• Safe drinking water	2	i		
	Improved pearl millet variety HKP	drought; wildfire	• Increase production • Guarantee food security	2	i	Training and awareness-raising in the use of improved agricultural techniques **	i
	Improved cowpea variety (IT90k372-1-2)	drought; wildfire	• Increase production • Guarantee food security	2	i		
DEAL WITH	Multi-nutritional fodder blocks for livestock	drought; wildfire	• Guarantee animal food security	3	i	** links to "Training and awareness-raising in the use of improved agricultural techniques"	
	Multigrain nutrient ball	flood; drought; dry spell	• Support balanced nutrition during floods • Can be included in the flood preparedness list of dry foods	3	i	Eradicating malnutrition by promoting locally produced Horlicks	i
	Emergency infrastructure including shelter and linked transport infrastructure	flood; rainstorm	• Protection of people and assets	3	c	Early warning message dissemination	c
		flood; drought				Community safety nets – Establishment of rice seed banks at village level	c
		flood; rainstorm; drought; dry spell; landslide				Comprehensive Agrarian Risk Management (GRAI)	c
		flood; drought; wildfire				Community storage facilities	c
		flood; rainstorm				Early warning system	c
		flood; drought; dry spell; landslide				Creating municipal risk management units (UGR) with a participatory approach	c

Table 2: Classification of the Technologies through the SLM lens

Cluster **Technology group** Technology	**Climatic zone**				**Main land use types**									**Degradation types**							**Hazard(s)**					
	arid	semi-arid	Sub-humid	humid	cropland	grazing land	forest/ woodlands	mixed	settlements/ infrastructure	waterways/ waterbodies/ wetlands	mines/ extractive industries	unproductive land	other	soil erosion by water	soil erosion by wind	chemical soil deterioration	physical soil deterioration	biological deterioration	water degradation	other	flood	rainstorm incl. cyclone	drought	dry spell	wildfire	landslide
Land-based																										
1 Reforestation/ vegetation cover improvement																										
Protection of microbasins through reforestation			■				■	■						■					■		■	■			■	■
Farmer Managed Natural Regeneration (FMNR)		■						■				■		■	■			■			■	■	■	■		■
Farming God's way			■		■			■								■	■	■				■	■	■		
Protection of water resources			■			■	■							■				■	■		■		■	■	■	■
2 Cross-flow barriers incl. microcatchments																										
Living barriers			■		■									■							■	■				
V-shaped catchment fence using Izote (Yucca sp.)			■		■									■							■	■				
Bench terracing			■		■			■						■							■	■				
Soil and water conservation channels			■		■			■						■							■	■				
Terra Preta raised garden beds			■		■									■				■			■	■	■	■		
3 Cross-flow drainage and redirection incl. macrocatchments and floodwater harvesting																										
Rock catchment	■					■								■					■			■	■			
Drainage fascines			■			■								■							■	■				■
Sub-surface water harvesting for more efficient use of water resources		■												■							■		■			
Land- and water-based																										
4 Productive infrastructure																										
Floating garden				■	■					■									■		■	■				
Artificial reef				■						■										■		■				
Keyhole garden		■	■	■	■									■							■	■	■			
Land-related																										
5 Adapted infrastructure																										
Disability-inclusive, flood resilient cluster village				■					■					■							■					
Emergency infrastructure including shelter and linked transport infra-structure				■	■				■					■							■	■				
Protection of water infrastructure against disaster risk			■						■					■				■	■		■	■				■
Pond Sand Filter (PSF)		■										■							■		■		■			
Water points for livestock in daily pastures		■				■								■	■		■				■	■	■			■
6 Adapted seeds/ crops																										
Improved pearl millet variety HKP		■			■									■		■		■					■		■	
Improved cowpea variety (IT90k372-1-2)		■			■											■							■		■	
7 Food/ fodder reserves																										
Multigrain nutrient ball			■	■																	■		■	■		
Multi-nutritional fodder blocks for livestock		■			■	■										■							■		■	

2.3 Analysis of Technologies

Land degradation exposing the land

Most Technologies are specific to a certain land use type. The Technologies analysed are found mainly on cropland and grazing land (see Figure 9) while several Technologies, such as 'Bench terracing', 'Soil and water conservation channels' and 'Farming God's way' in Uganda are applied on cropland as well as mixed land which includes grazing and trees. The type of land use is closely related to the type of land degradation which occurs on the land. WOCAT differentiates between six main types of land degradation, which are explained and illustrated in Table 3.

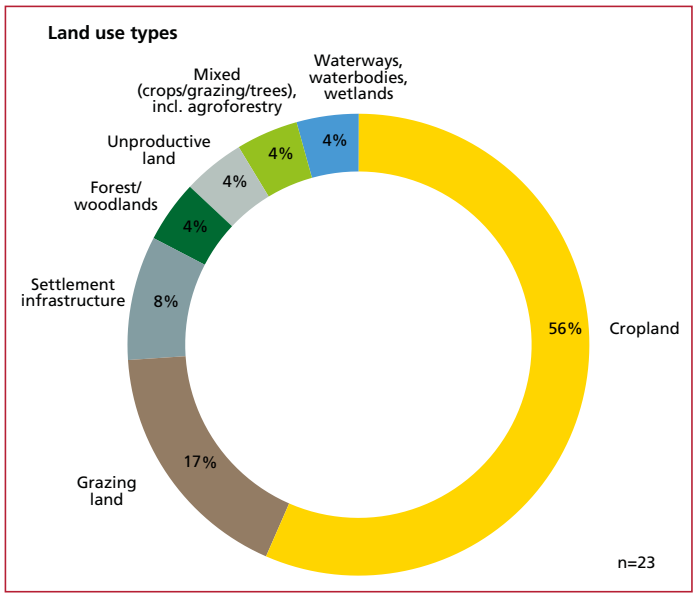


Figure 9: Land use types of the Technologies.

Land degradation *is the degradation of land resources (including soils, water, vegetation, and animals) leading to a reduction in the capacity of the land to provide ecosystem goods and services and assure its functions over a period of time for the beneficiaries of these.* (www.wocat.net/glossary)

In fact, 22 of the 24 Technologies are exposed to and address a specific type of land degradation. The exceptions are the 'Multigrain nutrient balls' (from India), which do not directly address land use as well as the 'Artificial reef' (a case from the Philippines) which is self-evidently located in the sea.

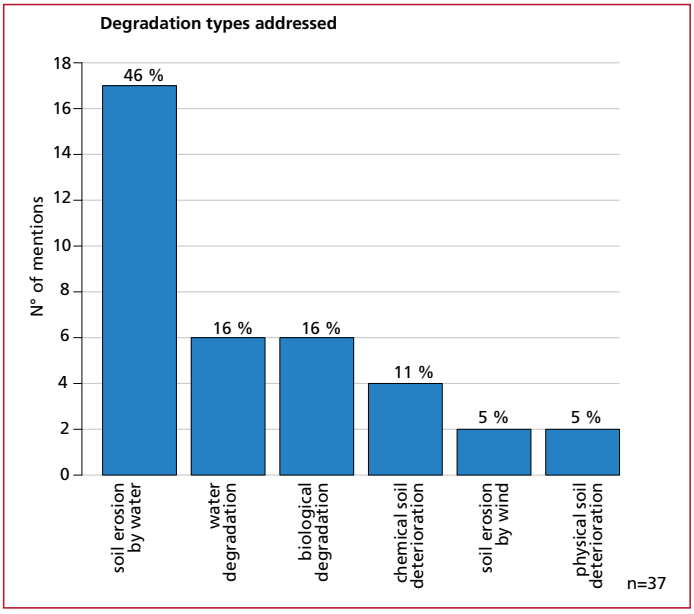


Figure 10: Degradation types addressed by the Technologies. A Technology may address several types of degradation and the sum of items displayed is therefore more than the total of 24 Technologies.

Water is the main element addressed – in fact by more than 50% of the Technologies. This is little surprise, given the fact that 19 out of the 24 Technologies address floods or rainstorms or both (as shown in Table 1). Soil erosion by water is the major degradation type – again addressed by almost half of the Technologies. For instance in the case of the 'V-shaped catchment fence using Izote' gully erosion is degrading the slopes and channelised runoff is putting at risk the houses of people living downslope. Izote plants (Yucca sp.) are planted within these gullies to stabilise them and retain sediments – which are then used creatively to form productive gully gardens. This activity in Honduras is combined with other Technologies in the same area, the innovative 'Drainage fascines' system on slopes, as well as 'Living barriers' hedgerows. Water degradation is the second main type of degradation addressed. The availability of sufficient and safe water is a key concern, and not only in areas exposed to dry spells and droughts. Commonly it is the combination of too much and too little precipitation which is an increasing challenge. Heavy rains and floods also jeopardize water resources whose catchments need to be protected through various interventions on the land as demonstrated by 'Protection of water resources' in Haiti. Biological degra-





Table 3: Types of land degradation as defined by WOCAT



Soil erosion by water
(e.g. gully erosion, mass movements/ landslides, loss of topsoil/ surface erosion)

Soil erosion by wind
(e.g. loss of topsoil, deflation and deposition)

Chemical soil deterioration
(e.g. fertility decline and reduced soil organic matter, soil pollution, salinization)

Physical soil deterioration
(e.g. compaction, sealing, waterlogging)

Biological degradation
(e.g. reduction of vegetation cover, loss of habitats, increase of pests/ diseases)

Water degradation
(e.g. change in quantity of surface water, decline of surface water quality)

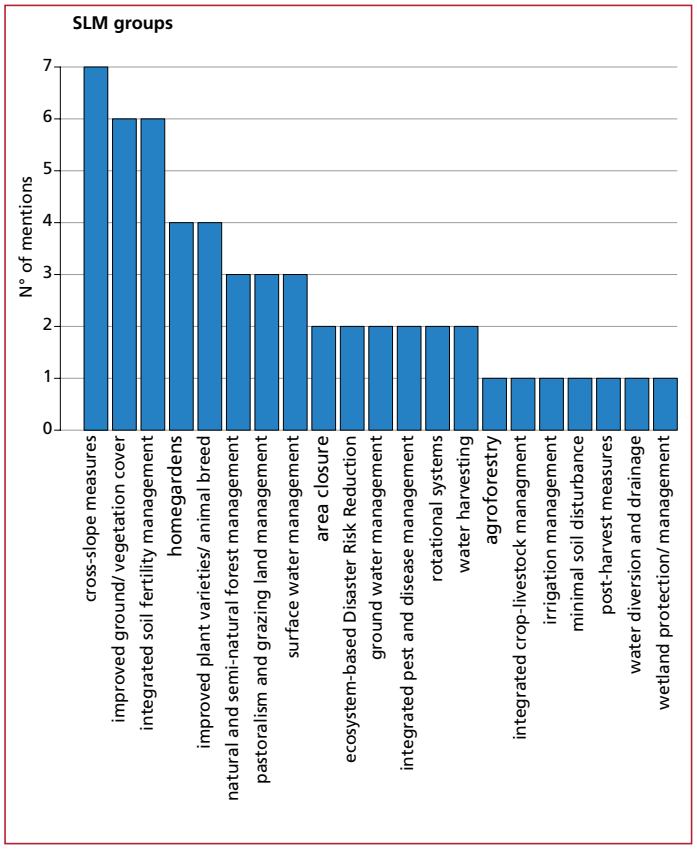


Figure 11: SLM groups representing the Technologies. A Technology may be included in several SLM groups and the sum of mentions displayed is therefore more than the total of 24 Technologies.

dation is mainly related to the reduction of vegetation cover by human activities: principally deforestation (of woody vegetation in general) or overgrazing by livestock, exposing bare soil to the sun, water and wind. The result is the soil losing its capability to deal with too much water because of reduced infiltration during heavy rains or storms, as well as too little water through diminished water holding capacity during dry spells. An example of how vegetative cover is brought back is 'Farmer Managed Natural Regeneration (FMNR)' in Kenya, where the original vegetation exhibits strong regrowth after the area has been fenced. Seawater intrusion and the related salinization of soils – relevant in the context of climate change and a rising sea level – is not addressed by any of the Technologies analysed.

Multi-purpose Technologies

Interestingly, land-based and land-related DRR Technologies cover a wide array of different topics, represented by the SLM groups in Figure 11. Technologies are very diverse in their nature, even though those analysed address 'only' six main hazards: flood, rainstorm, drought, dry spell, wildfire and landslide. What is remarkable is that 15 out of the 24 Technologies analysed can readily find a home under three SLM groups, showing that the Technologies have multiple objectives beyond their 'pure' risk reduction function. Cross-slope measures and vegetation cover are obviously effective in the context of weather- and climate-related hazards. Soil fertility improvement is a co-benefit of such good land management practices and in this sense is an extra benefit of those Technologies – though not constituting their primary purpose. Surprisingly, ecosystem-based DRR was only ticked twice, even though most of the land-based Technologies would actually fall into this category. This shows



left: HP. Liniger, Haiti – Southern slopes are more exposed to the cyclones in Haiti and thus suffer more from land degradation. Any improvement of the land with Sustainable Land Management practices have to take the high risk of extreme events into account.

centre: Swiss Red Cross, Honduras – The construction of V-shaped pile walls with plants is a soil bio-engineering measure that retains loose material behind the walls, prevents the formation of gullies and reduces gully erosion.

right: HELVETAS Swiss Intercooperation, Bangladesh - Trail bridge with local construction Technology to ensure access during monsoon season.

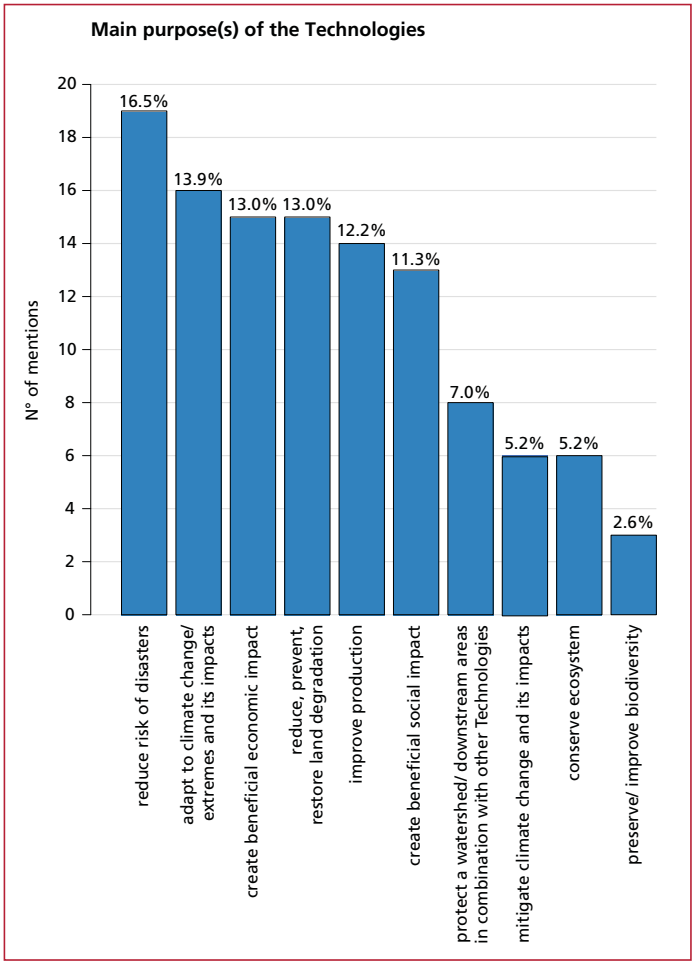


Figure 12: Main purposes of the Technologies.

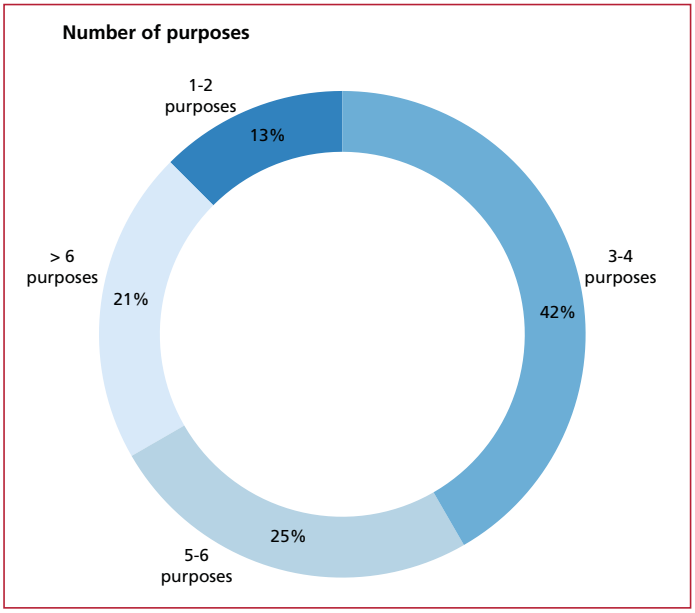


Figure 13: Number of purposes of the analysed Technologies (see Figure 12).

that even though the compilers of the Technologies were documenting DRR practices they were not assigning them to the concept of Eco-DRR. The reasons for this were not further investigated but it is assumed that the compilers in the country are simply not well aware of the concept of Eco-DRR.

Naturally, the majority of the Technologies declared DRR as one of the purposes (see Figure 12). The five that did not mention DRR ('Multi-nutritional fodder blocks for livestock', 'Artificial reef', 'Improved pearl millet variety HKP', 'Improved cowpea variety', and 'Pond Sand Filter') did however highlight adaptation to climate change/ extremes and its impacts as one of the purposes. In fact, as pointed out in Chapter 1.2, the concepts of DRR and CCA often overlap. The creation of beneficial economic impact is the third most common main purpose of the Technologies reported. It demonstrates nicely how the Technologies can contribute to improved livelihoods – and therewith increased resilience – through more financial capital generated through the Technology. Addressing land degradation, mainly caused by unsustainable land management and further enhanced through the exposure of the land to weather- and climate-related hazards is, not surprisingly, at the core of the land-based DRR Technologies. Also very prominent is the creation of beneficial social impact as well as improving production; both again contribute to strengthened livelihoods of households and communities.

It is remarkable that while less than half of the Technologies have three to four purposes, almost 50% have five or more (see Figure 13). This relates to the multiple co-benefits that can be derived from the land: socio-economic, socio-cultural as well as ecological benefits. The 'Terra Preta raised garden beds' in Haiti span DRR, community knowledge sharing, ecological health, vegetable production and household income. 'Keyhole gardens' in Bangladesh are remarkably similar in their impact: again they are not only about protection against hazards but also improving production.





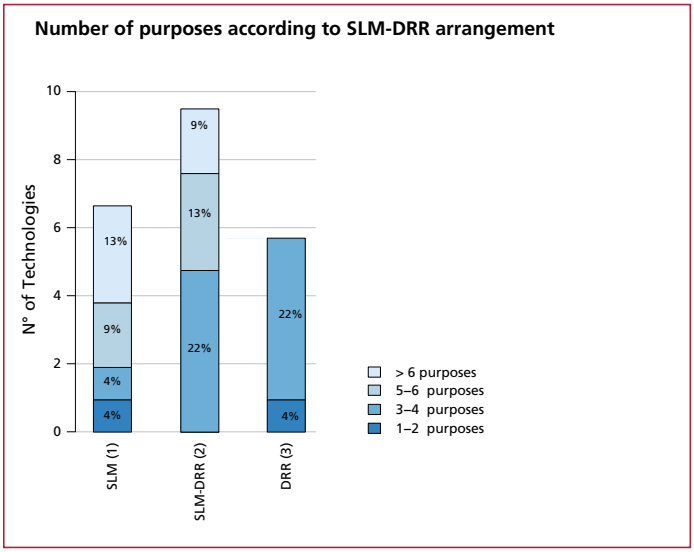


Figure 14: Number of purposes of Technologies according to whether they are more SLM-type (Category 1), more conventional DRR (Category 3) or in the middle (Category 2) pointing out the multi-purpose character of SLM-type Technologies.

A simple division into three categories is shown in Figure 14: Technologies that most resemble SLM (Category 1), those that are more conventional DRR (Category 3), and those that can be considered in the middle (Category 2), yields insights into the range of purposes. The SLM-type Technologies have a greater multi-purpose character, making use of the different functions and benefits from the land – in comparison to the more conventional DRR Technologies whose purposes are more tightly focused, unsurprisingly, as they generally relate to infrastructure-related practices. Category 2 then demonstrates the transition between the two. Where it is possible to build-in more SLM into DRR then there are opportunities for utilising the land and optimising the flow of benefits.

SLM measures

Generally, as is normally the case under SLM interventions, the Technologies featured here are made up of one or – very commonly – a combination of the following measures: agronomic, vegetative, structural and management (see Table 4). For instance, terraces – a typical structural measure – are often combined with other measures, such as grass on the risers for stabilisation and fodder (vegetative measure), or contour ploughing (agronomic measure). In the case from

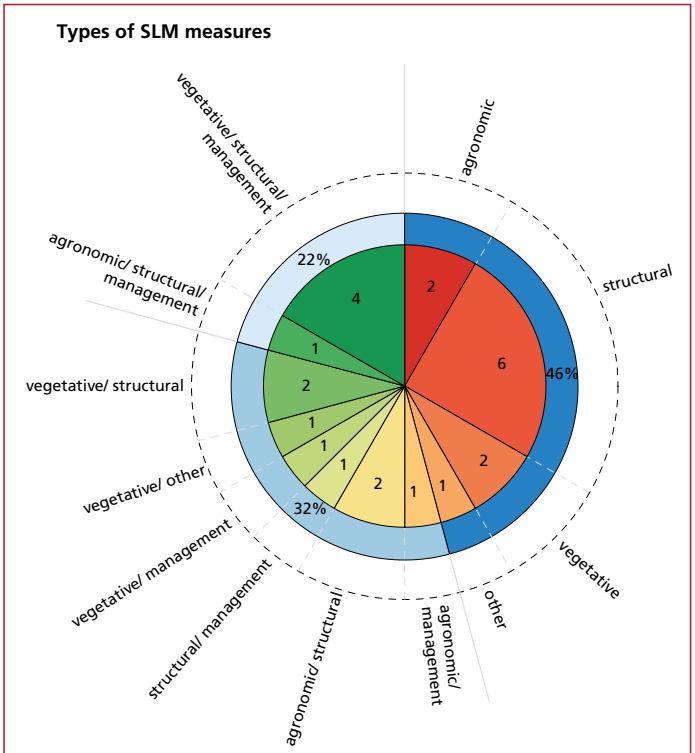


Figure 15: Types of SLM measures of the Technologies: single or combinations of two or three measures.

Uganda ('Bench terracing') there is indeed grass on the riser though no contour ploughing in this case as land is hand-hoed. Almost half of the analysed Technologies are made up of single measures, while the remainder include combinations of two or even three measures (see Figure 15). The interesting point here is that the Technologies range from relatively simple interventions to rather complex ones, including many different elements. This is the case for instance in the 'Disability-inclusive, flood resilient cluster village' in Bangladesh where there are not just infrastructural elements but also land use and management activities within the village; similarly the 'Protection of water resources' in Haiti has a series of different measures strategically located within three zones of the catchment area.

Costs and cost-benefit analysis

When compiling the cost of a Technology, all needed inputs are taken into consideration: including labour, equipment,

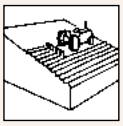


left: Tearfund, Uganda – Building of a soil and water conservation channel.

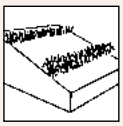
centre: Swiss Red Cross, Honduras – School children carry tree seedlings from the school nursery to be planted at the reforestation site. Involving schools for DRR is an important element of a sustainable and comprehensive community-based approach.

right: Swiss Red Cross, Haiti – Tree nurseries for reforestation and home gardening (fruit trees) are organised at community level and involve many community members.

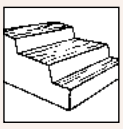
Table 4: Categories of SLM measures by WOCAT

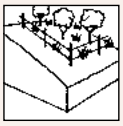
agronomic measures
- are associated with annual crops
- are repeated routinely each season or in a rotational sequence
- are of short duration and not permanent

vegetative measures
- involve the use of perennial grasses, shrubs or trees
- are of long duration

structural measures
- often lead to a change in slope profile
- are of long duration or permanent

management measures
- involve a fundamental change in land use
- invovle no agronomic and structural measures

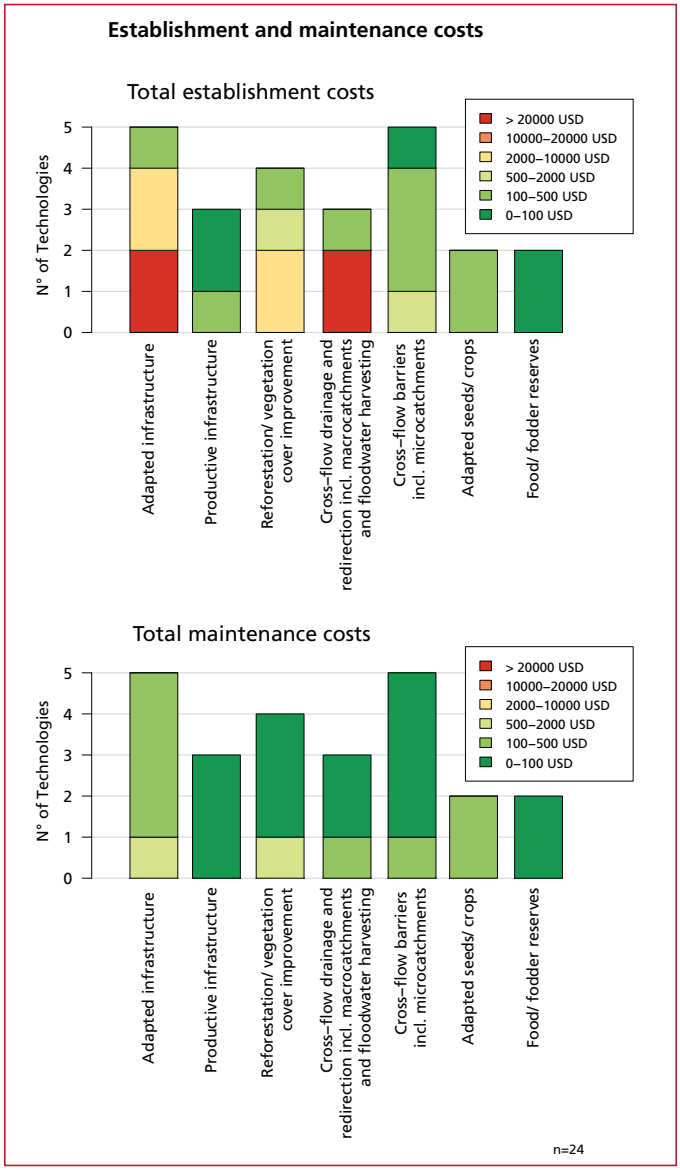


Figure 16: Establishment and maintenance costs in relation to the Technology groups.

plant material, fertilizers and biocides, and construction materials. Labour, even if unpaid (i.e. provided by family members as an in-kind contribution) is also costed. Establishment costs are those expenses which are incurred to set up the Technology. The establishment costs can last over a very brief period of time (e.g. for the construction of a pond sand filter) or over a longer span (e.g. for reforestation activities in a watershed). The maintenance costs relate to the recurrent expenses after establishment. They are regularly incurred and accounted for on an annual basis. They can include any of the inputs mentioned above.

As the Technolgies analysed are very diverse in their nature, so are their establishment costs: they range from 0-100 USD up to more than 20000 USD per hectare or unit (see Figure 16). Costs very much depend on the type of measure. Vegetative and agronomic measures are usually cheaper to implement than structural measures – which require considerable inputs and labour. What is remarkable is that the majority of the Technologies identified low maintenance costs. Higher maintenance costs are recorded under the group entitled 'Adapted infastructure'. Establishing and maintaining infrastructure comes at a higher cost than investing in land management where, after the initial investment - where for example land is restored as in the case of 'Farmer Managed Natural Regeneration (FMNR)' (from Kenya) – maintenance is a very low cost activity.

Nevertheless, in various contexts it takes much more than just investing in good land management in order to reduce



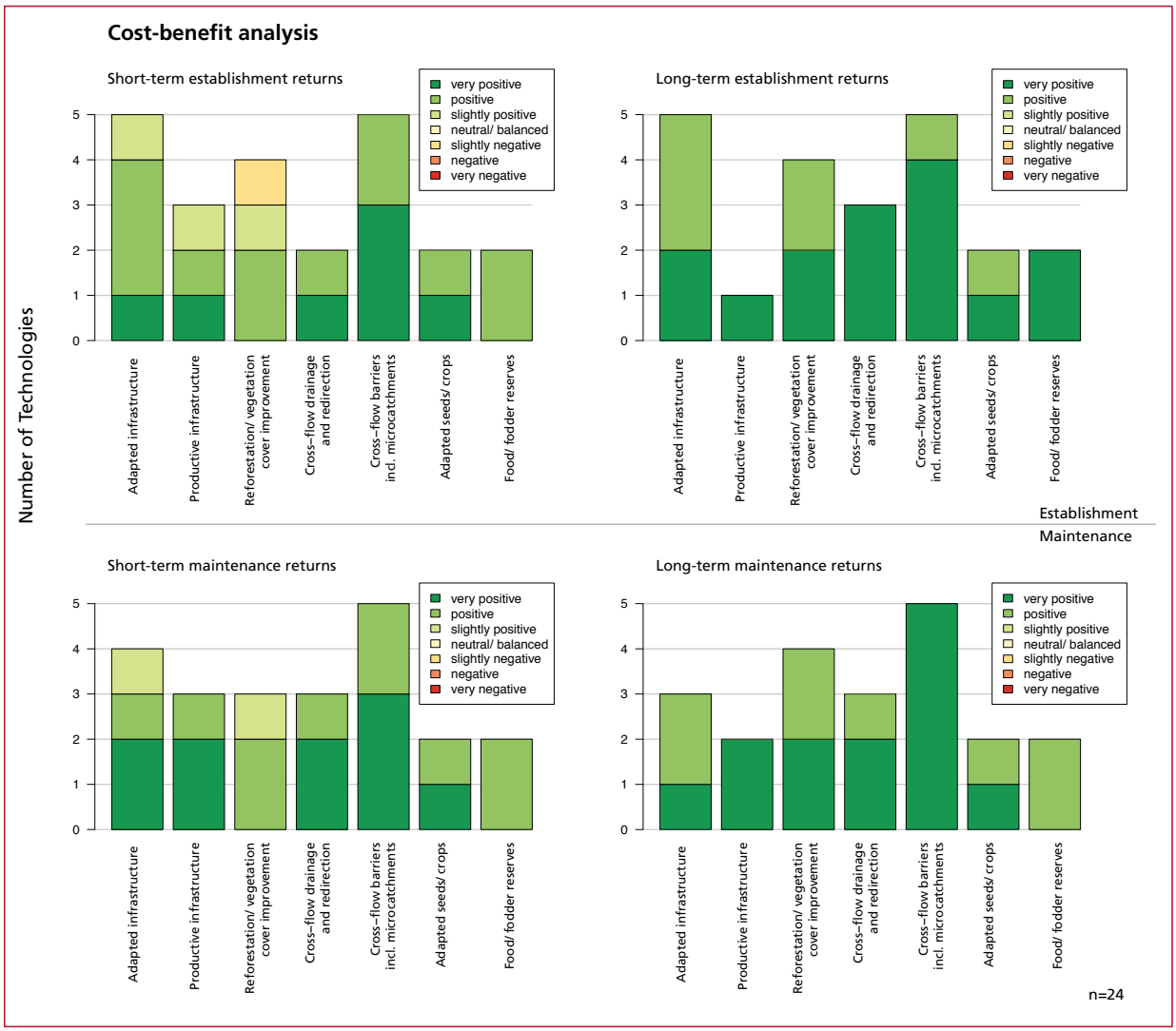



Figure 17: Perceived benefits of Technologies (per Technology group) in the short and long term and related to establishment and maintenance costs.

exposure and vulnerability: other investments are needed to save people's lives. In these situations, the costs can obviously be justified when lives are at stake as in the case of the two examples from Bangladesh: 'Disability-inclusive, flood resilient cluster village' and 'Emergency infrastructure including shelter and linked transport infrastructure'.

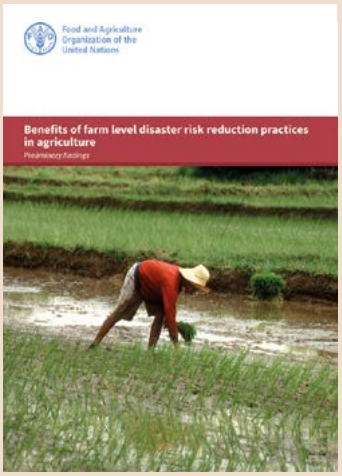
Costs and benefits are notoriously difficult to assess (few projects keep comprehensive records) and WOCAT thus focuses its attention on a proxy indicator - the perspectives of the land users/ stakeholders on how they define the short and long-term benefits as compared with establishment and maintenance costs (see Figure 17). Encouragingly, almost all the Technologies show positive results both in terms of short-term as well as long-term returns. The groups 'Cross-flow drainage and redirection' as well as 'Cross-flow barriers including microcatchments' show very positive cost-benefits both over short and long-term and



left: Swiss Red Cross, Honduras – Diverse soil-bioengineering measures are combined to stabilise a slope that poses a risk to a house nearby.

centre: CARITAS, Tajikistan – Flood defence structures are protecting downstream settlement from debris and loose materials carried by the yearly spring flood.

right: HEKS/ EPER, Ch. Bobst, Senegal – People in the region of Thiès are confronted with an increase in rainfall variability. To reduce erosion and slow down runoff they build small stone walls reinforced with fascines to retain soil and help groundwater recharge.



Box 4: Benefits of farm level DRR practices in agriculture

FAO, a consortium partner of WOCAT, works with governments and farmers to deliver DRR good practices in agriculture in areas prone to natural hazards. In order to better understand the benefits of the good practices, FAO is creating and testing a corporate methodology that can measure the scale of avoided damage and losses through the implementation of the good practices. FAO is also developing analysis methods that can help identify the DRR good practices that have the highest potential for replication and upscaling. Eventually, this information would provide policy makers with evidence to make informed decisions and to direct investments towards the most successful DRR practices that would improve the resilience of the agricultural livelihoods. In May 2017, FAO published the preliminary results from the pilot study that assessed the benefits of 25 DRR good practices that have been implemented at farm-level in 5 countries across Asia, Africa and South America (see www.fao.org/3/a-i7319e.pdf).

The preliminary results show that on average, the net economic benefits from improved farm-level DRR good practices are about 2.5 times higher than the usual practices adopted by farmers, livestock raisers and fishers. All of the practices analyzed are also no-regret measures, meaning that the improved practice help increase agricultural productivity regardless of the occurrence of hazards. In addition to the socio-economic and resilience benefits, DRR good practices bring a number of environmental co-benefits in terms of easing pressure over water resources, improving soil quality, cutting down the amount of inputs needed for production, and in some cases, reducing pollution and lowering carbon emissions. However, the performance of the good practices is highly context specific and more studies need to be conducted to fully assess their upscaling potential. For this reason, FAO is conducting further studies to assess more good practices from different agro-ecological and hazard contexts, with the final study expected to be published in mid-2018.

for establishment and maintenance. This can be explained by the use of vegetative and productive/ beneficial barriers, and management of water to make it more productive through water harvesting. As maintenance costs are low (apart from those cases where infrastructure is involved), long-term returns are also mainly positive to very positive.

Characteristics of land users/ stakeholders

The majority of the Technologies are implemented by, and for, very poor (33%) and poor people (59%) which is not surprising given the fact that the documented Technologies are promoted by NGOs whose explicit target beneficiaries are the poor. However, as many as 62% of the land users/ stakeholders have a mixed market orientation, meaning they are both subsistent and commercial while the remaining are merely subsistent. For the households whose market orientation is also commercial, it is very relevant to have/ invest in a 'productive' risk prevention or reduction measure, which enables them to sell some of the surplus/ products (e.g. wood, crops, fodder). For the subsistent households on the other hand the products play an important role for their livelihood and for food security.

On- and off-site impacts

The implementation of Technologies has impacts on-site, meaning in the area/ on the plot where the Technology is applied. The examples analysed demonstrate a series of different on-site impacts: socio-economic, socio-cultural and ecological. Increased production, farm income, drinking water availability and quality, and income diversity are some of the main socio-economic benefits obtained (Figure 18). It is important to note that Technologies are evidently successful in increasing production – and thereby helping to secure livelihoods – even if they are implemented primarily to cope with natural hazards. The main socio-cultural benefit reported by 50% of all Technologies is increased food security, which is clearly related to increased crop production, as well as drinking water availability. The major ecological benefits indicated are related to water: reducing runoff, draining excess water, reducing flooding, droughts, and landslides.

On the other hand, impacts can also be off-site: in adjacent areas/ neighbours' lands or further downstream. For DRR, the off-site impacts of Technologies in adjacent areas or downstream, are of particular relevance. Good land management upstream can prevent and/ or reduce disaster risk downstream. Although it is not easy to prove whether, and to what extent, a Technology/ Technologies upstream have had a positive impact downstream, several Technologies reported off-site impacts (see Figure 19). These impacts are mainly related to water: improving its availability, providing reliable and stable stream flows in the dry season, reducing flooding, reducing damage in neighbours' fields and damage to infrastructure also. The Technologies from



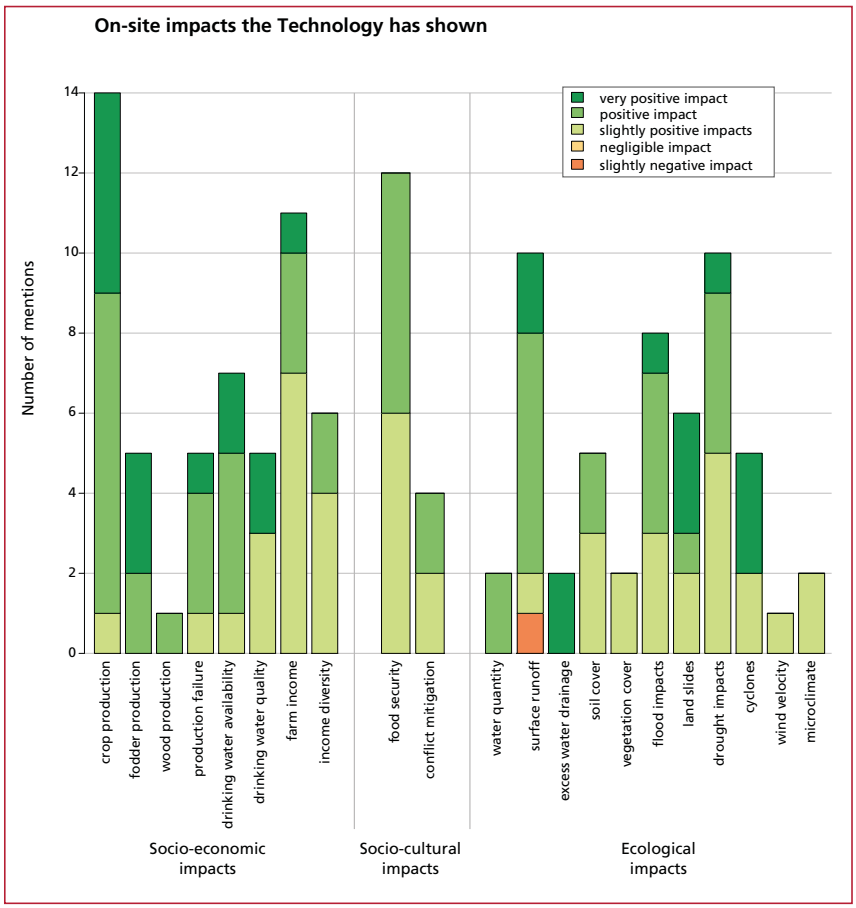


Figure 18: Selected on-site impacts the Technologies have shown.

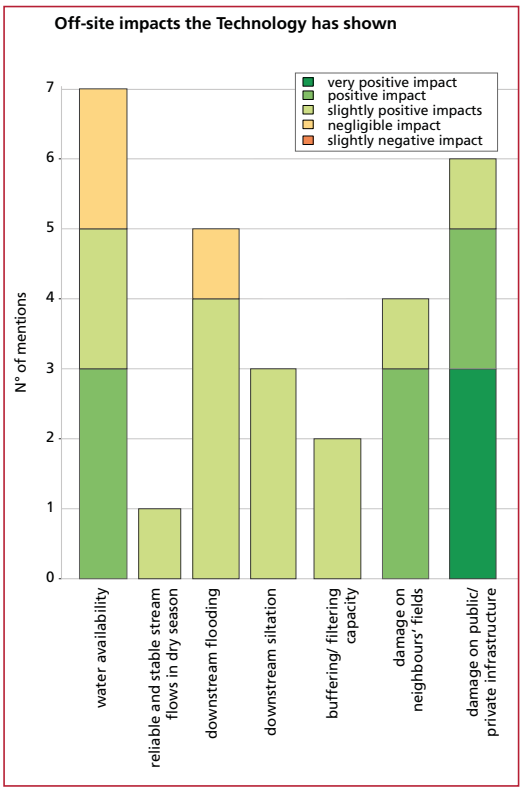


Figure 19: Reported off-site impacts of the Technologies.

which impacts are reported mainly relate to the following DRR Technology groups: 'Reforestation/ vegetation cover improvement', 'Cross-flow drainage and redirection' and 'Cross-flow barriers including microcatchments'. The major function is to improve water infiltration, reduce or control water flows and reduce siltation.

Coping with gradual climate changes and weather- and climate-related hazards

Different Technologies cope differently with gradual climate changes and weather- and climate-related hazards (see Table 5). The data shown is based on the experiences and information provided by land users or stakeholders using the Technology. It represents their personal assessment of which gradual changes and hazards are happening and how they evaluate the performance of the Technology when exposed to these.

Adoption

The 'adoption trend' describes the number of land users in the area who have adopted or 'taken up' the Technology by implementing it. Interestingly, the adoption trend is relatively high: in 38% of the cases analysed, more than 50% of land users in the area have adopted the Technology. With 29% of the Technologies, adoption is 10-50% of the land users (see Figure 20). Experience from WOCAT shows that adoption trends are often closely related to costs of establishment (and maintenance). Naturally, perceived benefits from the Technology also influence uptake. However, a key reason for the high adoption rates in the examples analysed



left: HELVETAS Swiss Intercooperation, Bolivia – Forests and farm land in remote hilly areas of Southern Bolivia.

right: HELVETAS Swiss Intercooperation, Bangladesh – Raised houses with wave erosion protection in the flood plains of Northern Bangladesh.

Coping with gradual climate change and hazards

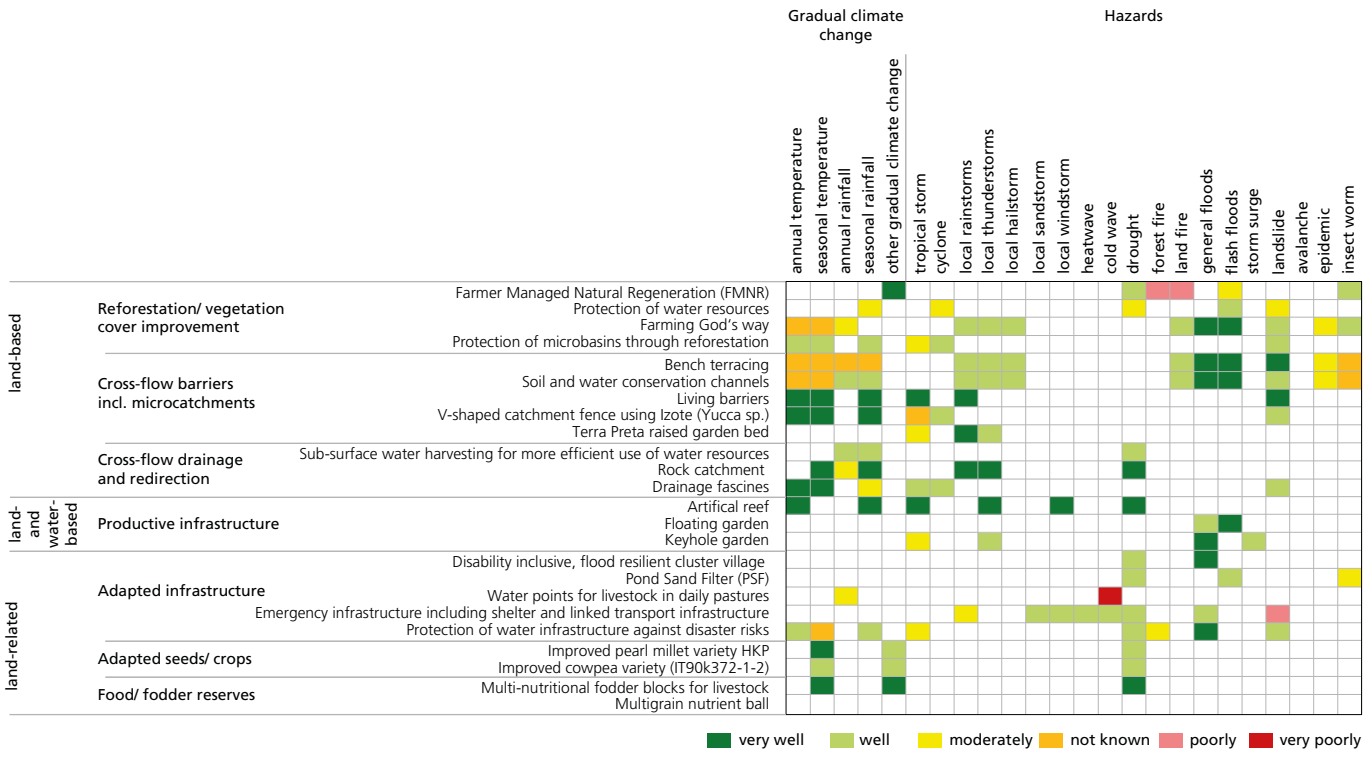


Table 5: Perceived gradual climate change and hazards and how the Technologies cope with these.

is very likely to be the low cost of land-based/ land-related Technologies, which households or communities can cover independently. However, in Bangladesh the 'Floating garden', which already existed in the area, has a very low adoption rate from 1-10% despite being cheap, whereas the low cost 'Keyhole garden', a fully introduced and new Technology, has an adoption rate of more than 50%.

2.4 Analysis of Approaches

An Approach helps to create the enabling environment for the adoption of one or more Technologies. Sustainability of interventions is key and a strong Approach will strive to guarantee the involvement and participation of local land users and communities. Different Approaches are needed in different contexts - to best suit the specific conditions. As shown in Table 1 (p. 26), Approaches can either target individuals, supporting them in building capacities for the implementation of one or several Technologies on their land, or they may be aimed at a community, implementing Technologies on a larger scale – community lands, a watershed or the landscape. Approaches can focus on several activities, and in this case a Technology may be just one of those activities, as in the case of 'Social enterprise' in the Philippines or the 'Water Use Management Plan' in Pakistan.

The majority of the stand-alone Approaches documented belong to the category deal with the risk. They are either 'preparedness and response' measures, such as the 'Early warning message dissemination' in Bangladesh or the 'Early warning system' in Chad. Or they are 'transfer and share' measures such as the 'Comprehensive Agrarian Risk Management' in Bolivia. Most of these Approaches stand or fall with the involvement of the community: in Cambodia, the Approach 'Community safety nets – Establishment of rice seed banks at village level' or the 'Community storage facilities' in Chad.





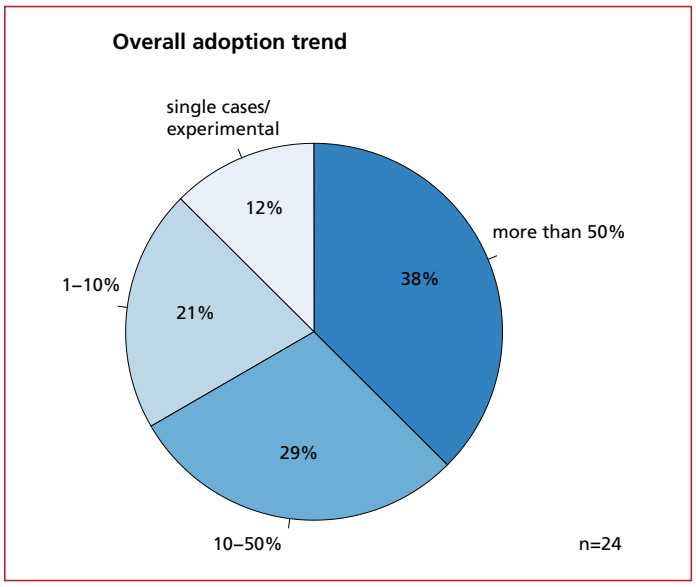


Figure 20: Overall adoption trend of the Technologies.

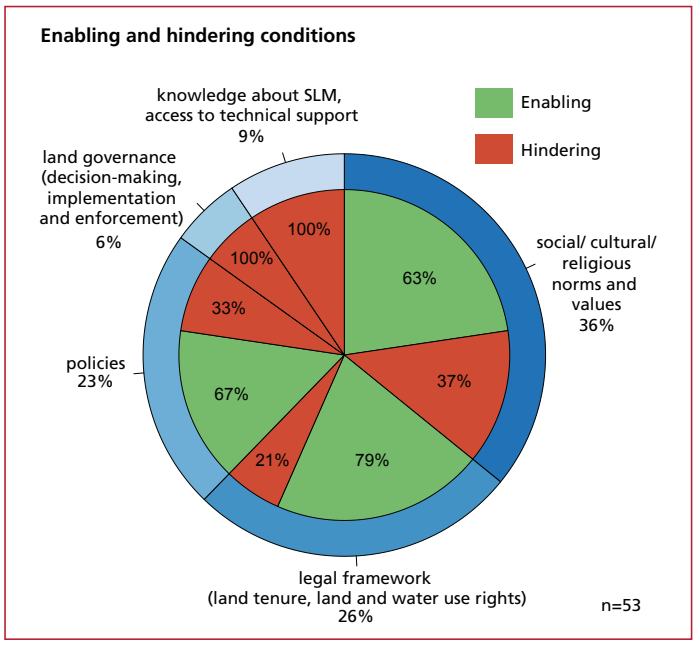


Figure 21: Conditions that enable or hinder adoption.

Enabling and hindering conditions

The legal framework and related policies are part of the enabling environment – but not the main factor in supporting adoption. As shown in Figure 21, the implementation of the Technology/ Technologies depends closely on social, cultural and religious norms and values. This may also be related to a recurring theme found in various examples where communities start taking responsibility for their own environment. For instance in Tajikistan, this is the case where the 'Pasture User Union' is establishing water points for livestock, and organises rotational grazing on community land to reduce overgrazing and related erosion and landslides. At the same time norms and values can also be a major hindering factor in implementing a Technology. The lack of knowledge about SLM or lack of access to technical support has also been mentioned as an important constraint. Here, obviously, the implementation of DRR Approaches is strengthened by helping to create the necessary skills and know-how of land users/ stakeholders to establish and/ or carry out a Technology, as is shown in the example from Niger 'Training and awareness-raising in the use of improved agricultural techniques'.

Community involvement and capacity building

In more than half of the cases, the local community is actively involved in all stages of the Approach by interacting with those carrying out the Approach (Figure 22). This clearly confirms the participatory nature and people-centred focus of the analysed DRR Approaches. Even in the monitoring phase, people are still very much involved. This may also be an indicator of the likelihood of sustainability, as people are participating throughout a project and, through joint monitoring, will also be in a good position to assess the potential for continuing activities or not. In fact, self-mobilisation is highest in the monitoring phase. The participatory nature of the DRR Approaches analysed is also confirmed in the way decisions are made together with local actors (see Figure 23). In the majority of the Approaches, both those that target individuals and those targeting communities, have been involved, consulted or supported in the process of selecting appropriate Technologies.

Capacity building and training of land users or other stakeholders usually form a key element of Approaches. It is hardly surprising then that in 100% of the Approaches analysed, some form or another of training was provided. This ranges from tree-pruning skills in Kenya's 'Farmer Managed Natural Regeneration (FMNR)', to financial risk transfer mechanisms in Bolivia's 'Comprehensive agrarian risk management' to water-crop budgeting in Pakistan's 'Water use management plan' initiative.



left: HELVETAS Swiss Intercooperation, Haiti – Community members making use of their new water point with an integrated washing place.

centre: Tearfund, Uganda – Building of ferrocement tanks.

right: Plan International, Nepal – Water tank.

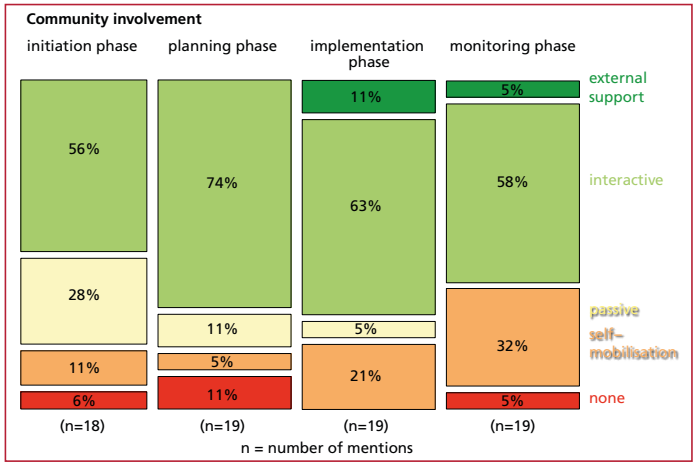


Figure 22: Involvement of the community in the different project/ programme phases.

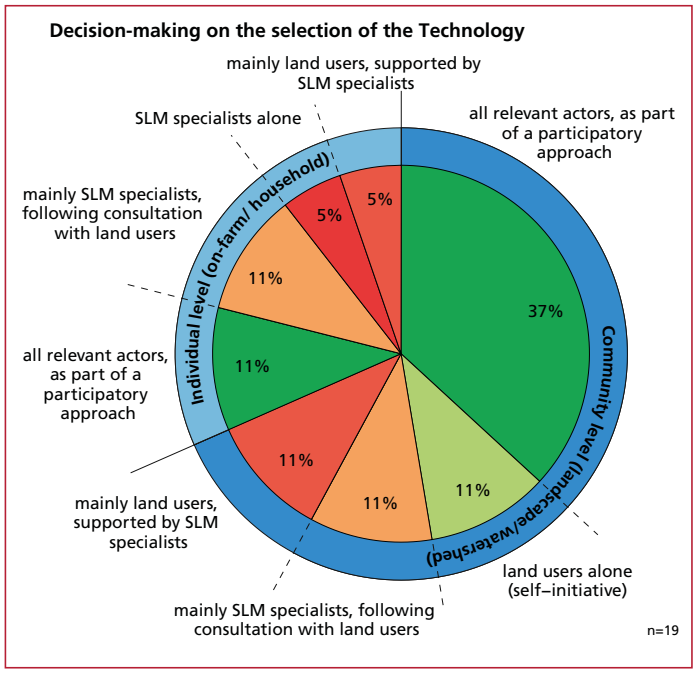


Figure 23: Participatory nature of decision-making processes for the selection of Technologies with local actors.

Again, this is a strong confirmation of the people-centred focus of the DRR Approaches and the value that is assigned to build capacity of people to be able to act and address

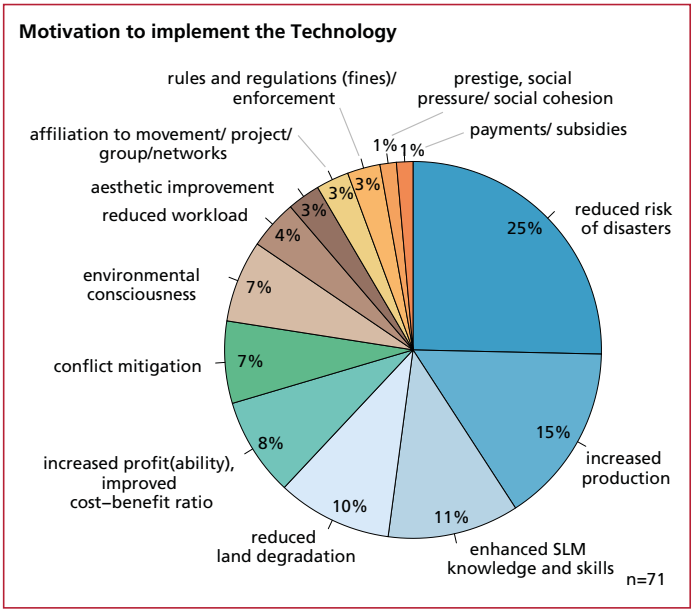


Figure 24: Main motivation of land users/ stakeholders to implement the Technology.

hazards independently. Considering the disaster risk equation, capacity is one of the main factors reducing disaster risk – and the easiest for a programme to influence. Through the realisation of participatory, people-centred approaches, these capacities can be strengthened and contribute to the reduction of disaster risk.

It is noteworthy that, in more than half of the 20 analysed examples, research was part of the Approach. Certain Approaches such as the 'Collection, selection, breeding and dissemination of locally adapted rice varieties at the Local Agricultural Research and Extension Centre LAREC' in Cambodia obviously include specific research activities. In others, such as in the example from Niger 'Training and awareness-raising in the use of improved agricultural techniques' researchers of the University of Maradi and the National Agronomic Research Institute work with the project to assess the impact of the Technology on the land users, as well as on factors determining the adoption of the promoted Technology.

The main motivation of land users/ stakeholders to implement Technologies is, not surprisingly, DRR. Increased production is the second most commonly mentioned and, in fact, many of the Technologies confirmed an increase





in production as shown in the on-site impacts section. The next series of motivations are all related to enhanced SLM knowledge including land degradation aspects and profitability from production (see Figure X).

3. Conclusions

SLM benefitting DRR and vice versa – making use of WOCAT in DRR

The practices analysed shed light on the diversity of available DRR initiatives and the fact that, very often, the same or similar practices are promoted under SLM, however commonly without a specific or articulated risk reduction objective. Naturally there are overlaps and sometimes no clear distinction between the two: 'Bench terracing' and 'Farmer Managed Natural Regeneration' are equally 'at home' under DRR or SLM. Another example is provided by homegardens. The WOCAT Database includes examples of homegardens from around the globe. However, homegardens which are specifically tailored to the context of natural hazards such as the 'Keyhole garden' and the 'Floating garden' (both used in Bangladesh), are new to the SLM community. Ironically while the 'Keyhole garden' was originally developed by African farmers to preserve their crops from wind and sand, it was then adapted successfully as a DRR Technology in the flood context of Bangladesh. The essence here is that SLM practitioners need to be aware of such developments – and indeed to be on the look-out for the DRR potential of some of 'their' Technologies: and DRR practitioners can pick up ideas from SLM. Thus both DRR and SLM communities can benefit from documentation and sharing of experiences (e.g. through the WOCAT Database) to identify good practices relevant to the context they are operating in and adapt them, if necessary, to the local conditions.

It is evident that many of the DRR practices showcased here, while they appear to be site-specific have the potential to be quite broadly applicable – though this will often mean tailoring to the local context. Taking the Approaches, which constitute the ways and means people are involved in undertaking the DRR practices, there are again many similarities with those documented under WOCAT for SLM. Both DRR and SLM projects and interventions can learn from these successful examples. However, the current exercise has shown that some land-related DRR practices, in particular those related to infrastructure, are less suitable for documentation under WOCAT – even though they are also partly related to land use and management (e.g. providing shelter to animals or facilitating the storage of seeds). Their main objective is to provide rescue and save lives, and that cannot be readily captured using the WOCAT Questionnaires and Database.

This Compendium confirms the value of standardised documentation and assessment of good practices – be it in DRR or in SLM. Only through a standardised data collection process and sharing of existing knowledge of successful interventions, for instance through a platform like WOCAT, common denominators and objectives can be shown and the benefits of SLM for DRR, and DRR for SLM, exemplified. This can foster a learning process between different (yet surprisingly similar) communities – DRR, CCA, SLM and others – and offers a basket of options and solutions to address natural hazards. How this can be best organised in practice is still to be discussed and agreed. But an immediate step is for the risk reduction function, particularly of land-based Technologies, to be highlighted in SLM and this can even serve as an additional argument for promoting SLM practices, for instance through WOCAT. At the same time, the ability of well-managed land to cope with hazards, preventing or reducing their impacts, is an argument for DRR to further promote SLM in DRR interventions and among practitioners. Increased productivity and production are furthermore co-benefits of SLM practices which make it attractive for land users to implement good land management practices.

Assessing risks, considering the land

Conducting systematic risk assessments, taking into consideration multiple hazards and analysing vulnerability, is key in underpinning a sound risk management strategy. The vulnerability of the land and the potential of SLM to prevent or reduce disaster risk should be considered when assessing risks, and acknowledgement of this will raise awareness and build capacities of land users and decision-makers. This can include the following elements:

- to investigate and assess the state of the land (in terms of degradation) – and with this the vulnerability of affected households/ communities, through considering the whole landscape and especially hydrologically defined watersheds;
- to understand how land is managed in affected communities including upstream areas – where damaging land management may further magnify the impacts of hazards - and which unsustainable management practices are contributing to disasters;



left: Swiss Red Cross, Honduras – Contour planting.

centre: HEKS/ EPER, Ch. Bobst, Senegal – To make best use of the scarce rainfall and poor soil, this farmer in Thiès plants his mangoes in Zaï pits.

right: HP. Liniger, Haiti – Agroforestry plots around the settlements – even if exposed to cyclones – protect the land and people.

- to identify which SLM Technologies already exist in an area/ watershed and what is their risk reduction function, as well as to identify Technologies that do not yet exist in the area but are documented and applied elsewhere in similar contexts: these could be introduced to prevent and reduce risk;
- to understand which Approaches are on the ground (in terms of organisation of people, roles and responsibilities) and define the most suitable enabling environment for the implementation of good practices;
- to decide, in a participatory way with local land users as well as decision-makers, which practices have the greatest potential to be scaled-up, considering different criteria developed jointly (see also WOCAT Decision Support process – www.wocat.net).

Facilitating local sustainability and ownership

As the cost-benefit analysis has shown, land-based/ land-related DRR practices are positive, both in the short- and long-term. This is a compelling reason for people to adopt and maintain such practices in preference to other costly measures, which are not possible without sustained external aid. Furthermore, the multi-purpose nature of land-related/ land-based practices and with it the socio-economic co-benefits reducing people's vulnerability, are convincing factors behind the adoption of good practices by land users.

A recurring theme is communities taking over responsibility for their environment, for instance in 'Local consultation for action on hillsides to protect water resources' in Haiti, 'Community storage facilities' in Chad or the 'Water Use Management Plan' in Pakistan. This confirms that if the value of the environment and land in particular is recognised, communities are prepared to take on management responsibility for their resources to address hazards. By building capacities to put into place different local measures, for instance through Approaches such as 'Participatory slope stabilisation' in Honduras or 'Training and awareness-raising in the use of improved agricultural techniques' in Niger, the adaptive capacity of the community and its members is increased and thereby the sustainability of such efforts facilitated. In this context, the combination of different Technologies and Approaches in a watershed or landscape, such as in 'Protection of water resources' in Haiti, is essential to provide the maximum protection of people and their land. Isolated Technologies, even though they may reduce the exposure of single households, are not enough to address the risks posed by hazards to whole communities. Larger areas of land need to be converted through continuous, sustained efforts of a community that is convinced of the need for their own inputs to help themselves.

Avenues for 'building back better'

Disasters have different magnitudes and, as mentioned earlier, it is mainly the small, recurring disasters affecting those least able to cope – which constitute the majority. These can be reduced substantially by relatively simple measures related to land management. While SLM interventions so far have mainly focussed on addressing land degradation problems through different Technologies and Approaches, there is a lot of potential for considering SLM options as risk prevention and reduction measures – admitting that land management cannot influence all disasters – but also in the process of rebuilding after a disaster has occurred. The DRR community has taken this up by promoting DRR practices that are related to land use and management and, more broadly, by focusing on nature-based solutions for DRR, including Eco-DRR. The SLM community should join efforts to 'build back better' (i.e. post-disaster rehabilitation) by providing a basket of options, highlighting the risk reduction functions of practices as well as the co-benefits (especially production and livelihoods) of land-based solutions.

However, as noted, SLM has its limitations. Large-scale disasters, putting at risk the lives of thousands of people, are obviously too massive for SLM to play a crucial role – at least in the short-term. Here, other types of interventions are needed. Furthermore, as disasters cannot be fully prevented and mitigated – even if good land management is in place – additional preparedness and risk transfer measures are needed in order to reduce disaster risk. Such measures, where necessary, should be added to good land management practices, to further reduce losses such as harvest or productive assets of land users and communities.

Resilient land for resilient people

Any effort to improve the resilience of the land will reduce the vulnerability of the people.

DRR focuses on people. Disasters have the greatest impact on the poor who are exposed, vulnerable and lack the capacity to manage disaster risk (including the recovery processes required). SLM however mainly focuses on reducing the exposure of the land to natural hazards and making



the land less vulnerable and thus more resilient. Land that is degraded means it is exposed, vulnerable and has little resilience to cope with hazards, with the degraded land becoming itself a driver of hazards. Unsustainable land management on the one hand increases the disaster risk by increasing the exposure and vulnerability. On the other hand, after disasters have happened, further land degradation is often the result, making the land even more vulnerable and exposed to new, future hazards. This becomes a vicious spiral of more and more degraded land and higher and higher disaster risks and impacts. Reduce the vulnerability of people without investing in resilient and healthy land is a key challenge. Improving the land and its capacity to absorb and deal with hazards before people have to take additional action should thus be a top priority. Consequently, efficient and effective DRR efforts need to address the issue of making the land more resilient as a basis for reducing vulnerability and disaster risks.

Productive protection

SLM produces ecological benefits which help to protect people and their land from hazards and their impacts. Additionally, as shown in the analysis, good land management is multi-purpose and produces numerous socio-economic benefits such as increased crop or fodder production, increased water availability and increased farm income. These benefits improve the livelihoods of people on an everyday basis and help them to be less vulnerable when exposed to hazards.



left: HP. Liniger, Tajikistan – Degradation in the watershed leads rivers posing a threat to people durinh heavy rains and floods. Trees were planted to stabilised the riverbed walls and protect the settlement and fertile agricultural land.

right: Swiss Red Cross, Honduras – Participatory slope stabilisation.

Policy Points

Learning and sharing knowledge

This exercise has documented, and analysed, several very effective DRR practices related to land and its management: and for the first time, systematically through an established methodology. There are clearly many good examples of preventing and reducing disaster risk through actions on, and related to, the land that exist worldwide. As has proved the case with SLM, systematic documentation and wide dissemination of such good practices is vital in order to learn from experience – and share lessons. Interestingly there are several examples of DRR initiatives recorded in this Compendium that have been recorded – but only as SLM practices.

SLM in DRR

It has become abundantly clear that SLM is central to many effective DRR initiatives – and the other way around too. There are clearly de facto strong links and considerable potential for synergies. This current exercise has articulated this relationship. It needs to be built on for more effective DRR, and to broaden even further the mandate of SLM. Each has much to learn from, and contribute to, the other.

Solutions for repeated small-scale disaster events

Simple SLM measures can help to substantially reduce the impacts of repeated small-scale disaster events. At the same time they often address several natural hazards simultaneously, making them an efficient and cost-effective risk reduction measure. This needs to be better recognised – and articulated – by the DRR community and is a justifcation for forging better links with those who specialise in SLM.

Local actions for local solutions

SLM is mainly about actions taken by individual land users and communities: DRR has demonstrated that this is very often the case too. Through forging active engagement and motivation of local people and support through sensitisation, awareness-raising, capacity building and instilling a sense of 'ownership', improved land management practices can be established and maintained, leading to more robust and sustained solutions. This needs to be even more eplicitly integrated into strategies in both domains.

Resilient land for resilient people

Sustainably managed land conserves ecosystem functions and makes the land more resilient to natural hazards as well as gradual changes, thereby reducing people's vulnerability and enhancing their resilience. Promoting the scaling-up of SLM activities from single plots to the landscape/ watershed level will lead to increasingly resilient land and thus more resilient households and communities under DRR interventions.

Productive protection

SLM produces ecological benefits which help to protect people and their land from hazards and their impacts – while at the same time being productive through related socio-economic benefits. The danger is that the poorest people on the most degraded land can become locked into a vicious cycle of poverty, degradation and disasters. SLM, with its emphasis on the land's health and productivity helps break this cycle and makes it intrinsically attractive to land users who stand to benefit directly. This is another argument for bringing more SLM into DRR initiatives.

Investing in land and land users for sustained risk prevention and reduction

Conserving and protecting land through SLM helps to maintain its capacity and functions to cope with hazards and therewith prevent and reduce disaster risk. Restoring degraded land through SLM restores its capacity and functions to cope with hazards and therewith reduces disaster risk. Simultaneously through involving land users in the processes of risk assessment and planning interventions linked to SLM, their capacity is built up – and they become aware of what resilience really means. This is crucial to ensuring sustainability.

Considering land when assessing risks and building back better

The role and potential of land for DRR should be taken into consideration when carrying out risk assessments as well as when 'building back' after a disaster has hit: by identifying unsustainable practices that have led to land degradation and increased exposure and replacing these with Sustainable Land Management practices that reduce exposure and vulnerability. SLM has a crucial role to play in helping the poorest rebuild lives and livelihoods after disasters.

More research and better targeted research required

There are a number of examples of where formal research has contributed to DRR. Better adapted varieties of seed is one obvious area: another is recording of vegetation rehabilitation. But research is also required at a 'higher' level for example to investigate to which point SLM practices are sufficient to create resilient land and people and define which additional preparedness and response and risk transfer and share measures are needed to reduce the residual risk to a minimum.

HP. Liniger, Haiti – Cultivated steep slopes repeatedly hit by cyclones have been severely degraded and finally abandoned. Yet, around houses productive agroforestry systems have been established. A degraded area has been restored with afforestation and agroforestry (green plot in the background) and is a proof of the potential to restore degraded land and its resilience within less than ten years.



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Part 2



Swiss Red Cross, Honduras – Steep and deforested slopes pose a threat to homesteads; the slopes are stabilised with soil bio-engineering measures such as contour-planting for progressive terracing.



where people and their land are safer





SWISS NGO DRR PLATFORM

WOCAT
World Overview of Conservation Approaches and Technologies

Content of Part 2

Technologies and Approaches – titles and page numbers

Technology			Approach		
PREVENT AND REDUCE					
	Tajikistan	**Water points for livestock in daily pastures** Additional DRR Information available p 53		Tajikistan	**Pasture User Union** Additional DRR Information available p 61
	Philippines	**Artifical reef** in PDF		Philippines	**Social Entreprise (SE)** in PDF
	Haiti	**Protection of water resources** p 69		Haiti	**Local consultation for action on hillsides to protect water resources** Additional DRR Information available p 77
	Honduras	**Living barriers** in PDF		Honduras	**Participatory slope stabilisation** Additional DRR Information available p 91
	Honduras	**Drainage fascines** p 85			
	Honduras	**V-shaped catchment fence using Izote (*Yucca sp.*)** in PDF			
	Uganda	**Bench terracing** in PDF			
	Uganda	**Farming God's way** in PDF			
	Uganda	**Soil and water conservation channels** p 99			
	Kenya	**Farmer Managed Natural Regeneration (FMNR)** Additional DRR Information available p 107		Kenya	**FMNR implementation approach** p 119
	Honduras	**Protection of microbasins through reforestation** in PDF		Honduras	**Legal protection of microbasins through decrees*** in PDF

Technologies and Approaches – titles and page numbers

Technology			Approach		
REDUCE					
	Honduras	**Protection of water infrastructure against disaster risks** in PDF		Honduras	** links to "Legal protection of microbasins through decrees"*
	Kenya	**Rock catchment** p 125		Kenya	**Partnership with beneficiary communities in project implementation** Additional DRR Information available p 133
	Bangladesh	**Disability-inclusive, flood resilient cluster village** Additional DRR Information available p 141		Bangladesh	**Disability-inclusive Disaster Risk Reduction** Additional DRR Information available p 151
	Pakistan	**Sub-surface water harvesting for more efficient use of water resources** Additional DRR Information available p 159		Pakistan	**Water Use Management Plan (WUMP)** p 169
	Haiti	**Terra Preta raised garden beds** p 175		Haiti	**Approach at household level for Terra Preta homegardens** Additional DRR Information available p 183
				Cambodia	**Collection, selection, breeding and dissemination of locally adapted rice varieties at the Local Agricultural Research and Extension Centre (LAREC)** in PDF
	Bangladesh	**Keyhole garden** Additional DRR Information available p 191		Bangladesh	**Peer to peer pass-on approach with women** p 201
	Bangladesh	**Floating garden** Additional DRR Information available p 207			
	Bangladesh	**Pond Sand Filter (PSF)** in PDF			
	Niger	**Improved pearl millet variety HKP** Additional DRR Information available p 217		Niger	**Training and awareness-raising in the use of improved agricultural techniques **** p 225
	Niger	**Improved cowpea variety (IT90k372-1-2)** in PDF			

Technologies and Approaches – titles and page numbers

Technology			Approach		
DEAL WITH					
	Niger	**Multi-nutritional fodder blocks for livestock** p 231		Niger	*** links to "Training and awareness-raising in the use of improved agricultural techniques"*
	India	**Multigrain nutrient ball** Additional DRR Information available p 237		India	**Eradicating malnutrition by promoting locally produced Horlicks** Additional DRR Information available p 245
	Bangladesh	**Emergency infrastructure including shelter and linked transport infrastructure** Additional DRR Information available p 251		Bangladesh	**Early warning message dissemination** Additional DRR Information available p 263
				Cambodia	**Community safety nets – Establishment of rice seed banks at village level** Additional DRR Information available p 273
				Bolivia	**Comprehensive Agrarian Risk Management (GRAI)** Additional DRR Information available p 281
				Chad	**Community storage facilities** in PDF
				Chad	**Early warning system** in PDF
				Bolivia	**Creating municipal risk management units (UGR) with a participatory approach** Additional DRR Information available p 289

Note: Additional DRR-relevant information is added to a Technology and/ or Approach where available.



Herders and animals coming to drink at the water point in the upper pasture zone of Dehbaland village (Nicole Stolz).

Water points for livestock in daily pastures (Tajikistan)

Нуқтаи обнушии чорво

DESCRIPTION

Water points for daily use in pastures, reducing erosion and enhancing productivity of cattle and other livestock.

Water points for livestock are used in semi-arid and arid regions where livestock are kept on daily pastures and water is distant or difficult to access. Bringing water from springs or other sources to water points in pastures greatly increases livestock productivity and improves reproductive performance. Difficult and distant access to water exhausts the animals, reducing production of meat and milk and reproductive capacities by up to 50%.

By providing water points in pastures, negative effects on livestock productivity can be reduced to a minimum. In order to implement the technology, water sources with perennial flow have to be identified with the shortest possible distance to and from the different grazing grounds. As a next step, in Tajikistan, water and land ownership and user rights must be regulated. Rights to pasture users are either given by the community or individual land and water owners. If the water source and a location for construction are found within a reasonable distance of the different pasture grounds, a drinking water system for livestock can be designed and constructed. Construction involves spring water collection, laying of pipes and finally installation of the water point. Besides the direct benefits (i.e. increased productivity and reproduction), the water points in the pastures reduce erosion from cattle tracks in often critical locations such as steep slopes surrounding springs. Water points also protect springs from being destroyed or spoiled by the animals. Thus the technology has a risk reduction benefit. A potential negative effect of the technology is a reduction of biodiversity, as extracting water from catchment springs may result in fewer natural fauna and flora in the micro-environments around the springs.

LOCATION



Location: Muminabad, Dehbaland, Khatlon, Tajikistan

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites
- 70.07469, 38.04565

Spread of the Technology: evenly applied at specific points/ concentrated on a small area

Date of implementation: 2014

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

CARITAS Schweiz Suisse Svizzera Svizra



Animals drinking at a water point (Sa'dy Odinashoev).



Animals drinking at a water point (Nicole Stolz).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Grazing land - Extensive grazing land: Semi-nomadism/ pastoralism

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology: n.a.
Livestock density: high

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Comment: Water points in daily pastures lead to less trekking of herds from and to natural water sources, as water is brought to the animals. Density of animals around natural water source leads to damage by trampling through compaction of land, while overgrazing leads to vegetation losses, that lead to increased washing or blowing away of soil. Trampling can also destroy a natural water source and make it unusable.

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying



soil erosion by wind - Et: loss of topsoil



physical soil deterioration - Pc: compaction, Pu: loss of bio-productive function due to other activities

SLM group

- pastoralism and grazing land management
- surface water management (spring, river, lakes, sea)

SLM measures



structural measures - S7: Water harvesting/ supply/ irrigation equipment

TECHNICAL DRAWING

Technical specifications

Water is collected in underground pipes and from surface runoff, passes through a filter which additionally regulates the flow and is led to the water point structure. The length of the tubes (see drawing) allows for collecting water from a surface of several hectares. The structure is made of concrete and consists of two basins, holding together approx. 4m³ of water.

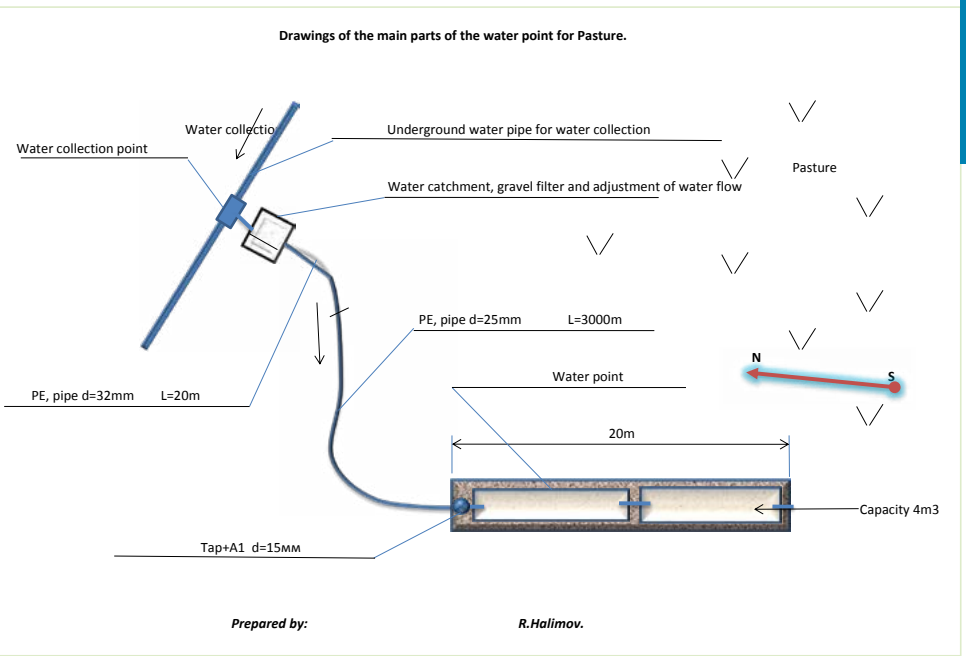

Figure: R. Halimov

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **one water point** volume, length: 18m, 4,5m³)
- Currency used for cost calculation: **Tajik Somoni**
- Exchange rate (to USD): 1 USD = 8.0 Tajik Somoni.
- Average wage cost of hired labour per day: 45 Somoni (5.5 USD per day).

Most important factors affecting the costs

Cost of tubes and cement, i.e. the distance of the next suitable spring to the pasture area; land ownership: state owned land rented to the Pasture Union.

Establishment activities

1. Identify water sources (spring detection) (Other measures; early spring and late autumn (observe at least over two years))
2. Identify where a potential water point should be placed in the pasture area (Other measures)
3. Identify the land ownership (Other measures)
4. Design of the system (Other measures)
5. Tapping and protecting the spring (Structural)
6. Digging trenches and laying pipes (Structural)
7. Connecting the tubes to spring catchment (Structural)
8. Construct water point (Structural)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Labour	person/ days	77.0	45	3465	20
Equipment					
Material Transport Dushanbe-Muminabad	trips (truck with diver)	1.0	3050	3050	0
Transport in the district Center to construction place	trips (truck with diver)	3.0	150	450	0
Plant material					
Tubes	m	1820.0	4	7280	0
Cement	kg	1800.0	1.06	1908	0
Gravel	m³	6.0	180	1080	0
Construction material					
Tubes	m	1820.0	4	7280	0
Cement	kg	1800.0	1.06	1908	0
Gravel	m³	6.0	180	1080	0
Total costs for establishment of the Technology				**27501 Tajik Somoni**	

Maintenance activities
1. Close/ open water point during winter time / spring (Management; twice per year)
2. Small repairs (Structural)

Comment: Water points from cement are not very maintenance intensive. Herders will take care of the water points as they are daily there. It is important that the pipe system is fully covered with soil so that the animals will not destroy any surface tubes.

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Clean outlet of water point to reduce erosion	days	2.0	45	90	0
Control spring catchment (illegal cutting of trees, any other changes in vegetation to assess output of spring) and line	days	2.0	45	90	0
Control water line - walk along the tubes and control for leakages)	days	1.0	45	45	0
Equipment					
shovel	item	1.0	150	150	0
Construction material					
Water tap	item	1.0	500	500	100
Gravel bed around water point	kg	20.0	20	400	0
Replacement of tubes	M	200.0	4	800	0
Total costs for maintenance of the Technology				**2075 Tajik Somoni**	

NATURAL ENVIRONMENT

Average annual rainfall
- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☑ 751-1000 mm
- ☐ 1001-1500 mm
- ☐ 1501-2000 mm
- ☐ 2001-3000 mm
- ☐ 3001-4000 mm
- ☐ > 4000 mm

Agro-climatic zone
- ☐ humid
- ☐ sub-humid
- ☑ semi-arid
- ☐ arid

Specifications on climate
Average annual rainfall in mm: 800.0
Spring and autumn rainfall
continental climate

Slope
- ☐ flat (0-2%)
- ☐ gentle (3-5%)
- ☐ moderate (6-10%)
- ☐ rolling (11-15%)
- ☑ hilly (16-30%)
- ☐ steep (31-60%)
- ☐ very steep (>60%)

Landform
- ☐ plateau/ plains
- ☐ ridges
- ☐ mountain slopes
- ☑ hill slopes
- ☐ footslopes
- ☐ valley floors

Altitude
- ☐ 0-100 m a.s.l.
- ☐ 101-500 m a.s.l.
- ☐ 501-1000 m a.s.l.
- ☑ 1001-1500 m a.s.l.
- ☐ 1501-2000 m a.s.l.
- ☐ 2001-2500 m a.s.l.
- ☐ 2501-3000 m a.s.l.
- ☐ 3001-4000 m a.s.l.
- ☐ > 4000 m a.s.l.

Technology is applied in
- ☑ convex situations
- ☐ concave situations
- ☐ not relevant

Soil depth
- ☑ very shallow (0-20 cm)
- ☐ shallow (21-50 cm)
- ☑ moderately deep (51-80 cm)
- ☐ deep (81-120 cm)
- ☐ very deep (> 120 cm)

Soil texture (topsoil)
- ☐ coarse/ light (sandy)
- ☑ medium (loamy, silty)
- ☐ fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- ☐ coarse/ light (sandy)
- ☐ medium (loamy, silty)
- ☑ fine/ heavy (clay)

Topsoil organic matter content
- ☐ high (>3%)
- ☑ medium (1-3%)
- ☐ low (<1%)

Groundwater table
- ☐ on surface
- ☐ < 5 m
- ☐ 5-50 m
- ☑ > 50 m

Availability of surface water
- ☐ excess
- ☐ good
- ☑ medium
- ☐ poor/ none

Water quality (untreated)
- ☑ good drinking water
- ☐ poor drinking water (treatment required)
- ☐ fine/ heavy (clay)
- ☐ for agricultural use only (irrigation)
- ☐ unusable

Is salinity a problem?
- ☐ yes
- ☑ no

Occurrence of flooding
- ☑ yes
- ☐ no

Species diversity
- ☐ high
- ☑ medium
- ☐ low

Habitat diversity
- ☐ high
- ☑ medium
- ☐ low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [ ] manual work
- [x] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Comment: Access to land is through inheritance, purchase or loaning.

Land use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓			good
education	poor		✓		good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor		✓		good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor		✓		good
financial services	poor	✓			good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

animal production	decreased						✓		increased
water availability for livestock	decreased							✓	increased
water quality for livestock	decreased					✓			increased
farm income	decreased					✓			increased
workload	decreased					✓			increased

After SLM: 50% increase
Comment: More meat, milk (average 1 litre before, after 3 litres) and higher productivity (every second year, now every year).

After SLM: permanently available
Comment: There was no water available before the intervention in the pasture area, and animals need to walk for several km to reach water down in the valley or even back to the villages.

Comment: Animals have access to improved water quality (i.e. tap water).

After SLM: 30% increase
Comment: Animals are healthier. Farmers have more milk and meat due to improved access to water and less movement during the day.

Comment: Work for herders became easier, as they have to walk less with the animals to find water.

Socio-cultural impacts

n.a.

Ecological impacts

surface runoff	increased		✓						decreased
landslides/ debris flows	increased					✓			decreased
drought impacts	increased						✓		decreased

Comment: Negative side effect, as water beyond the need of animals runs off unused.

Comment: Erosion reduced due to improved land cover as animals do not go into spring catchments. Reduced movements of animals also reduces trampling and loss of vegetation cover in watershed areas.

Comment: Tap water remains accessible in droughts.

Benefits compared with establishment costs

Short-term returns	very negative						✓		very positive
Long-term returns	very negative							✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative							✓	very positive
Long-term returns	very negative						✓		very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change
annual rainfall decrease — not well at all: | | | ✓ | | | very well

Climate-related extremes (disasters)
cold wave — not well at all: | ✓ | | | | | very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- ✓ 10-50%
- more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ✓ 0-10%
- 10-50%
- 50-90%
- 90-100%

Number of households and/ or area covered
20 water points have been established that are used by more than one village herd.

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Improved water management has improved livestock production by controlled grazing and access to water at daily pasture points.
- Transporting livestock from steep valley locations to water drinking points was previously labour intensive, a farming activity which has improved due to dedicated water points.
- Water quality at drinking points is good enough to be used by farmer and herders as well.

Key resource person's view

- Erosion by livestock has been reduced as livestock grazing is more controlled and better distributed compared to before the project interventions. Runoff and effects of flooding are reduced.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Water points and farms are remote, and construction requires machinery and a challenge to transport materials to upper pasture zones.

Key resource person's view

- Investment costs are still considered to be too high to be fully borne by pasture users. → *Pasture User Unions have been formed which collect fees. The unions help to save money for technology investments.*

REFERENCES

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Resource persons: Sa'dy Odinashoev (sady.dc@mail.ru) – SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/ technologies_623/
Linked SLM data: SLM Approach: Pasture User Union: https://qcat.wocat.net/en/wocat/approaches/view/approaches_629/
Documentation was facilitated by: CARITAS
Disaster Risk Management in Tajikistan: https://www.caritas.ch/de/was-wir-tun/engagement-weltweit/

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		✓			
Extra tropical storm		✓			
Drought	✓				
Biological hazards					
None					
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

Exposure						
of people	very high/ strong		✓			very low/ non-existent
of private assets	very high/ strong		✓			very low/ non-existent
of community land	very high/ strong			✓		very low/ non-existent
of community infrastructure	very high/ strong				✓	very low/ non-existent
Economic factors						
Access to markets	very high/ strong				✓	very low/ non-existent
Income	very high/ strong				✓	very low/ non-existent
Diversification of income	very high/ strong				✓	very low/ non-existent
Savings/stocks	very high/ strong				✓	very low/ non-existent
Bank savings/remittances	very high/ strong					✓ very low/ non-existent
Degree insurance coverage	very high/ strong					✓ very low/ non-existent
Social factors						
Literacy rate	very high/ strong				✓	very low/ non-existent
Government support	very high/ strong				✓	very low/ non-existent
Family support	very high/ strong			✓		very low/ non-existent
Community support	very high/ strong				✓	very low/ non-existent
Access to public services	very high/ strong				✓	very low/ non-existent
Physical factors						
Robustness of houses	very high/ strong				✓	very low/ non-existent
Robustness of infrastructure	very high/ strong				✓	very low/ non-existent

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- substantial increase in losses
- ✓ some increase in losses
- no change
- small reduction in losses
- substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
0	0
1	1

People directly affected by disasters

over the last 5 years	over the last 15 years
0	0
1-10	1-10

- [x] 2-5
- [ ] 6-10
- [ ] 11-50
- [ ] > 50

- [ ] 2-5
- [ ] 6-10
- [x] 11-50
- [ ] > 50

- [ ] 11-50
- [ ] 51-100
- [ ] 101-200
- [ ] 201-500
- [x] > 500

- [ ] 11-50
- [ ] 51-100
- [ ] 101-200
- [ ] 201-500
- [x] > 500

% of land destroyed by disasters

over the last 5 years

- [ ] 0% (no damage)
- [x] 1-20%
- [ ] 21-50%
- [ ] 51-80%
- [ ] 80-100%

over the last 15 years

- [ ] 0% (no damage)
- [x] 1-20%
- [ ] 21-50%
- [ ] 51-80%
- [ ] 80-100%

% of land affected by disasters

over the last 5 years

- [x] 0% (no damage)
- [ ] 1-20%
- [ ] 21-50%
- [ ] 51-80%
- [ ] 80-100%

over the last 15 years

- [ ] 0% (no damage)
- [x] 1-20%
- [ ] 21-50%
- [ ] 51-80%
- [ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years

- [ ] 0 USD
- [ ] 1-1000 USD
- [ ] 1001-5000 USD
- [ ] 5001-10'000 USD
- [ ] 10'001-50'000 USD
- [ ] 50'000-250'000 USD
- [x] > 250'000 USD

over the last 15 years

- [ ] 0 USD
- [ ] 1-1000 USD
- [ ] 1001-5000 USD
- [ ] 5001-10'000 USD
- [ ] 10'001-50'000 USD
- [ ] 50'000-250'000 USD
- [x] > 250'000 USD

Duration since last disaster

- [ ] < 3 months
- [x] 3-6 months
- [ ] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Technology

Water post reduce risk of erosion and landslides at slopes. Without water point in pasture areas, livestock and cattle are moves twice per day from pasture grounds on hills down to valley bottom. This constant up and down is not only having negative impact on reduced productivity of animals, but as well has negative impact on slope stability. Through trampling erosion and uncontrolled grazing of bush vegetation on slopes infiltration rates of water are reduced leading to higher run off and increase flood risks as well as stability of slopes are reduced that lead to increased risk of landslides.

IMPACTS

Additional benefits of the Technology

Safety (on-site)

Safety of people	decreased		increased
Safety of esp. vulnerable	decreased		increased

Economic goods (on-site)

Safety of individual housing	decreased		increased
Safety of water stocks	decreased		increased
Safety of seed/animal stocks	decreased		increased
Safety of land assets	decreased		increased
Safety of communal assets	decreased		increased

Off-site impacts

As water points are constantly running there is an increased effect of erosion below of the water point. This negative impact has to be either reduced by measures to enhance infiltration, or by using the water for irrigation at lower laying orchards or fields. Reduced water in the spring catchment and in valley as water is brought to the pasture areas.



Pasture User Union meeting in Tajikistan (Margaux Thain).

Pasture User Union (Tajikistan)

Jamiyati charogoh istifobarandagon

DESCRIPTION

Livestock holders at the village level have joined a Pasture User Unions to access various rights provided under the national law entitled "About Pastures" passed in 2013. Among other advantages, the Pasture User's Unions (PUUs) are able to obtain ownership of communal collective pasture land, have the right to collect fees to improve the pasture, and to balance livestock and available fodder amounts in the watershed areas.

The Pasture User Union (PUU) is the legal entity at the village level. All households within the village are represented by one female and one male representative. At the general assembly, 11 people are selected as the governing body of the union. The union is entitled to:

- receive a land certificate for communal collective daily pastures near to the village, as well as more distant summer pastures;
- collect fees according to a system they can decide at their general assembly (in the study case the fees were based on numbers of livestock);
- can use the collected fees to improve the pastures in the villages;
- can represent villagers' interests when it comes to land use conflicts related to pasture and livestock.

The Pasture User Unions have an obligation to:

- pay taxes to the land use committee;
- sustainably use their pasture land.

Pasture User Unions were trained by SLM specialists from CARITAS Switzerland on a series of technologies to improve their grazing land. Relevant technologies consist of rotational grazing, placement of waterpoints in pasture areas, calculation of stocking rates, implementation of contour lines of trees etc. All these technologies aim at sustainable use of the land that results in increased vegetative cover, increased infiltration of water, and reduced erosion, degradation and mass movement (i.e. landslides) and negative impacts downstream (by flooding and sedimentation). As one of the only functioning structures at village-level, with access to resources, the Pasture User Unions take the lead during disasters and emergencies. PUUs have, for example, evacuated livestock during flood events in a collective manner. They have also organised a "Hashar" i.e. collective voluntary work to clean flood channels crossing their villages. The longer term impact of PUUs both at watershed level with improved pasture management and at village level with improved preparedness against disasters like floods and droughts is as yet difficult to assess.

LOCATION



Location: Muminabad, Khatlon, Tajikistan

Geo-reference of selected sites

- 70.03372, 38.0935

Initiation date: 2013

Year of termination: n.a

Type of Approach

- traditional/ indigenous
- ✓ recent local initiative/ innovative
- project/ programme based

CARITAS Schweiz Suisse Svizzera Svizra



Watershed degradation and loss of vegetation cover by overgrazing and trampling by animals. Pasture User Unions regulate grazing to reduce and halt land degradation, for example by keeping livestock on slopes on defined paths to the pastures to reduce destruction of vegetation by trampling (Fazila Beknazarova).



Small scale landslide triggered by heavy rains and combined with loss of vegetation cover due to deforestation and overgrazing (Fazila Beknazarova).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Enhance rights and profit of livestock ow ners at the community level.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **availability/ access to financial resources and services:** as a legal entity (i.e. the Pasture User Union) services can be accessed - for example credits. Projects can thus cooperate with the PUU and receive resources.
- **collaboration/ coordination of actors:** Bringing together people facilitates collective action, especially that related to communal work such as cleaning of flood channels, and legal frameworks (land tenure, land and water use rights): Based on the pasture law passed, a series of rights are given to Pasture User Unions.
- **legal framework (land tenure, land and water use rights):** Based on the pasture law passed, a series of rights are given to Pasture User Unions.
- **land governance (decision-making, implementation and enforcement):** PUUs are responsible for managing land governance and land user conflicts.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **legal framework (land tenure, land and water use rights):** Missing legal frameworks in neighbouring countries can be an obstacle.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities:** PUUs are composed of a maximum of 2 representatives of each household in the community- the PUU should be composed of 50% women and 50% men. Out of those community representatives 11 people are elected as the governing body of the PUU (the women's quota should be at least at 30%).
- **SLM specialists/ agricultural advisers:** Private sector rural advisory services provide support for pasture improvements. Veterinary services enhance animal health. Rural advisory services are available at the district level and support farmers and farmer groups with payable advice on agricultural questions. Veterinary services are available at the district level on demand, they provide vaccination and treatment for animals.
- **NGO:** Supports the capacity building of the union by training and a free rural advisory service as well as awareness raising on legal situations. Regular visits to the management board of the PUU as well as an open door for questions by PUU.
- **national government (planners, decision-makers):** Guarantees the fulfilment of rights provided in the law "About pastures".

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation	Specify who was involved and describe activities
initiation/ motivation		✓				Originally, technologies to improve the use of pastures were introduced by CARITAS Switzerland, which helped the farmers to organise themselves into livestock committees.
planning				✓		CARITAS and livestock committee members were involved in developing and passing the law "About Pasture" in Tajkistan to ensure the protection of community pastures.
implementation					✓	Implementation is entirely in the hands of the unions.
monitoring/ evaluation					✓	Monitoring is entirely in the hands of the unions.

Flow chart

Muminabad Pasture User Union in the organogram.

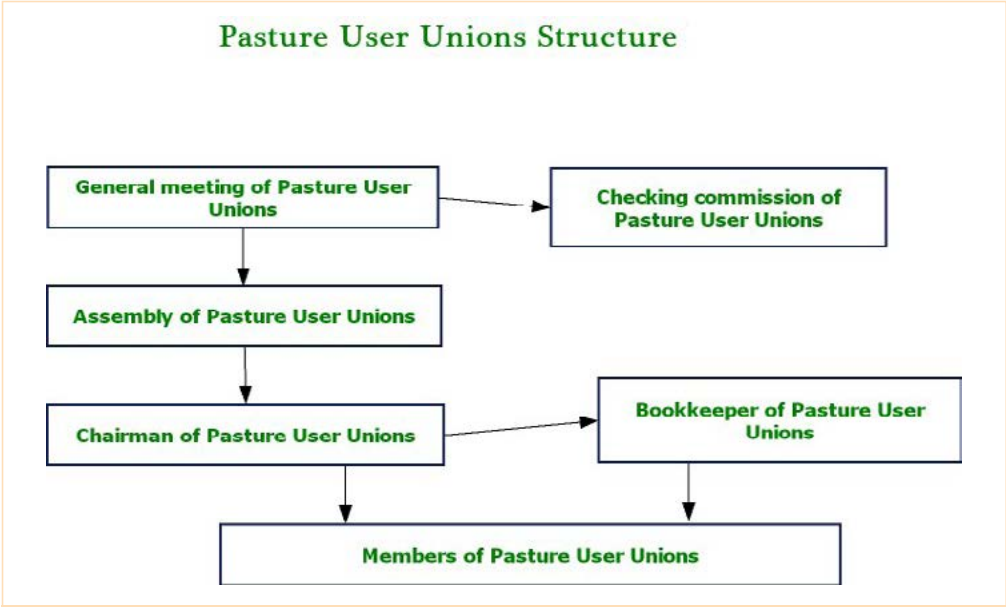


Figure: Sa'dy Odinashoev

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- all relevant actors, as part of a participatory approach
- ✓ mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- ✓ personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- Research

Capacity building/ training

Training was provided to the following stakeholders

- ✓ land users
- Advisory service

Form of training

- on-the-job
- ✓ farmer-to-farmer
- demonstration areas
- public meetings
- ✓ courses

Subjects covered

- Awareness raising of livestock owners about carrying capacity/ stocking rates on pastures.
- Facilitation of introduction of rotational grazing system of spring, summer and autumn pastures. Skills training for herders including identification of when pasture is ready for grazing (i.e. beneficial herbs already have produced seeds).
- Training of farmers in the PUU in cultivation of fodder crops (e.g. alfalfa, esparcettes, etc.).

Advisory service

Advisory service was provided
- [x] on land users' fields
- [ ] at permanent centres

Comment: NGO services helped to set up the pasture management system by facilitation through visual aids like watershed maps showing soil quality, slope gradients, vegetation cover, etc. Together, the number of livestock in the community and the fodder needs of the community was established and then the NGO guided the discussion to identify pastures, define rotational schemes, identify potential options of water points on daily pastures, identify arable land to cultivate fodder, and identify and demarcate paths for herds to reach daily pastures.

Institution strengthening

Institutions have been strengthened/ established
- [ ] no
- [ ] yes, a little
- [ ] yes, moderately
- [x] yes, greatly

at the following level
- [x] local
- [ ] regional
- [ ] national

Describe institution, roles and responsibilities, members, etc.
While the institutions are local and at the municipal level, the law is established at the national level.

Type of support
- [ ] financial
- [x] capacity building/ training
- [ ] equipment
- [x] legal advice

Further details
Mainly technical trainings on pasture management as well as legal how to apply and register pasture land for the use by the PUU.

Monitoring and evaluation
Yes pastures conditions are monitored twice a year by PUU.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component
- [x] < 2000
- [ ] 2000-10000
- [ ] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Precise annual budget: 1000.0

Comment: Collection of fees per head of livestock.

The following services or incentives have been provided to land users
- [x] Financial/ material support provided to land users
- [x] Subsidies for specific inputs
- [ ] Credit
- [x] Other incentives or instruments

Financial/ material support provided to land users
The PUU as one of the only juridical entities at grassroots level is a preferred partner in the implementation of larger projects of International NGOs and UN. For example the PUU in Muminabad district received a much higher share of agricultural machinery from an IFAD project than other districts in the project area, as the PUU guaranteed a collective ownership, which is more efficient than a single ownership for an agricultural machinery.

Subsidies for specific inputs (including labour)

Labour by land users was
- [x] voluntary
- [ ] food-for-work
- [ ] paid in cash
- [ ] rewarded with other material support

Other incentives or instruments
Policies and regulations to provide incentives to create PUUs.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach enable evidence-based decision-making? *Watershed maps were used as powerful visual tools to identify pastures and rotational grazing schemes.*			✓	
Did the Approach help land users to implement and maintain SLM Technologies? *Working together as a legally recognised union empowers people and helps to share the work that otherwise is assumed by livestock owners alone.*				✓
Did the Approach improve coordination and cost-effective implementation of SLM? *Which technologies are used, is decided at the union level and not the household level; which pasture land can be used by the village is decided at the national level and is guaranteed for long term use*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The PUU as a juridical entity has access to different services and benefits e.g. PUU were beneficiaries of a IFAD donation of agricultural machinery.*				✓

Did the Approach improve knowledge and capacities of land users to implement SLM? *Trainings was provided to the stakeholders.*	✓
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *There is a regular exchange forum between state and PUU at provincial and national level.*	✓
Did the Approach mitigate conflicts? *One of the functions of the unions is to mitigate land users' conflicts, but more time is needed to assess its efficiency in this function.*	✓
Did the Approach improve gender equality and empower women and girls? *By a quota of 50% women in the union: beyond this no further training is provided to women.*	✓
Did the Approach improve issues of land tenure/ user rights that hindered implementation of SLM Technologies? *The PUU is the key to fulfilling the rights of communal pasture land certified by the state.*	✓
Did the Approach lead to improved food security/ improved nutrition? *An estimated increase of income of 50% by applying the different technologies connected to the approach*	✓
Did the Approach lead to improved access to water and sanitation? *For animals on pastures.*	✓
Did the Approach lead to employment, income opportunities? *Jobs as herdsmen are created and substantial increases in income are generated by healthier animals (more milk, more meat).*	✓

Main motivation of land users to implement SLM

- ✓ increased production
- ✓ increased profit(ability), improved cost-benefit-ratio
- ✓ reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- environmental consciousness
- customs and beliefs, morals
- enhanced SLM knowledge and skills
- aesthetic improvement
- ✓ conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: As the PUU has become a legal entity for governing pastures in Tajikistan, including the right to collect money and an obligation to pay taxes, it is highly likely that the approach will be sustainable. Social and economic benefits in being organised as a PUU clearly over-weigh negative aspects like spending time in meetings.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Increase in productivity (milk and meat) and reproduction of animals.
- PUU members gain the right to have collective land tenure guaranteed for long term (99 years) by the state of Tajikistan.

Key resource person's view

- The PUU is entitled by the law "About Pastures" to act on behalf of the community related to all pasture issues.
- Enhances the implementation and governance of technologies to improve pasture management.
- Being part of the judiciary, PUU provides multiple benefits to the community i.e. having their own account, having the right to collect fees and having the obligation to pay taxes.
- Improved pasture management reduces downstream risks (floods, erosion), land degradation and enhances longer term soil fertility.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- There is not enough food/ dairy processing equipment to maximise benefits from milk meat, and wool. Need to establish a functioning cold chain for the different diary → *Get more project support.*

Key resource person's view

- Given the success of the approach, the price of meat has decreased in the market (from 30 Somoni to 25 Somoni for 1 kg of beef). This provides a low value for livestock production to farmers. → *Move from quantity to quality of product. Improve food processing standards in the local market.*
- Provide incentives to reduce livestock numbers in the watershed by diversifying farmer income such as increasing milk and meat productivity. → *Stall feeding, improved breeds, zero grazing etc.*

REFERENCES

Compiler: Boris Orlowsky – borlowsky@caritas.ch
Resource persons: Sa'dy Odinashoev (sady.dc@mail.ru) – SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_629/WOCAT
Linked SLM data: SLM Technology: Water points for livestock in daily pastures https://qcat.wocat.net/en/wocat/technologies/view/technologies_623/
Documentation was facilitated by: CARITAS
Links to relevant information which is available online: Law "about pastures" passed on 19th March 2013: http://cis-legislation.com/document.fwx?rgn=59051

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami		✓			
Mass movement		✓			
Flood		✓		✓	
Landslide		✓		✓	
Convective storm (Tornado, Hailstorm…)					
Extreme Temperature (Heat/Frost)		✓	✓		
Drought			✓		
Biological hazards					
Epizootics (animals)			✓		
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Approach was applied

Exposure							**Comments:**
of people	very high/ strong		✓			very low/ non-existent	*Mostly floods*
of private assets	very high/ strong		✓			very low/ non-existent	
of community land	very high/ strong			✓		very low/ non-existent	
of community infrastructure	very high/ strong			✓		very low/ non-existent	
Economic factors							
Access to markets	very high/ strong				✓	very low/ non-existent	
Income	very high/ strong				✓	very low/ non-existent	
Diversification of income	very high/ strong		✓			very low/ non-existent	
Savings/stocks	very high/ strong				✓	very low/ non-existent	
Bank savings/remittances	very high/ strong				✓	very low/ non-existent	*200 Somoni*
Degree insurance coverage	very high/ strong				✓	very low/ non-existent	
Social factors							
Literacy rate	very high/ strong	✓				very low/ non-existent	
Government support	very high/ strong		✓			very low/ non-existent	*Related to pasture*
Family support	very high/ strong			✓		very low/ non-existent	
Community support	very high/ strong			✓		very low/ non-existent	
Access to public services	very high/ strong				✓	very low/ non-existent	
Physical factors							
Robustness of houses	very high/ strong			✓		very low/ non-existent	
Robustness of infrastructure	very high/ strong			✓		very low/ non-existent	

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- [ ] substantial increase in losses
- [x] some increase in losses
- [ ] no change
- [x] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[x] 0	[x] 0
[ ] 1	[ ] 1
[ ] 2-5	[ ] 2-5
[ ] 6-10	[ ] 6-10
[ ] 11-50	[ ] 11-50
[ ] > 50	[ ] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[x] 11-50	[ ] 11-50
[ ] 51-100	[x] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[ ] > 500	[ ] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[x] 0% (no damage)	[x] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[x] 1-20%	[x] 1-20%
[ ] 21-50%	[ ] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[ ] 0 USD	[ ] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[ ] 1001-5000 USD	[ ] 1001-5000 USD
[x] 5001-10’000 USD	[ ] 5001-10’000 USD
[ ] 10’001-50’000 USD	[x] 10’001-50’000 USD
[ ] 50’000-250’000 USD	[ ] 50’000-250’000 USD
[ ] > 250’000 USD	[ ] > 250’000 USD

Duration since last disaster

- [ ] < 3 months
- [x] 3-6 months
- [ ] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Approach

Pasture User Unions protect pastures from degradation process stemming from overgrazing and reduce by this the risk of loss of vegetation cover and mass movements.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased		increased
Evacuation and shelter	decreased		increased
Safety of esp. vulnerable	decreased		increased
Early warning	decreased		increased
Safety of key documents	decreased		increased

Economic goods (on-site)

Safety of individual housing	decreased		increased
Safety of water stocks	decreased		increased
Safety of seed/animal stocks	decreased		increased
Safety of land assets	decreased		increased
Safety of communal assets	decreased		increased

Off-site impacts

None



Fencing around the protection zone of a water resource, before revegetation (HELVETAS Swiss Intercooperation Haiti).

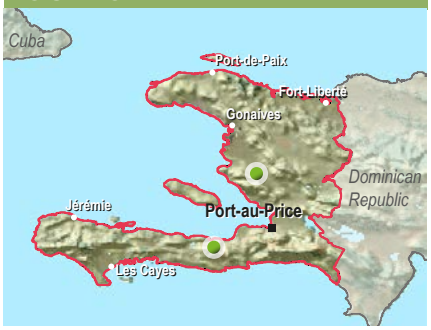
Protection of water resources (Haiti)

DESCRIPTION

The protection of water resources is essential for the supply of drinking water in the rural zones of Haiti, to ensure water quality and to facilitate recharge. Organising the actors involved in water resources is crucial, and there are several economic, environmental and community challenges. This implies, apart from sound management, the implementation of various technical measures.

The majority of water resources in Haiti are subject to bacterial contamination, which endangers the health of consumers. The infrastructure for the abstraction and conveyance of water is periodically put to the test by the large variation of discharge, from floods to periods of low flow. The protection of water resources aims, simultaneously, to strengthen local actors in their management capacity. The objective is to protect water resources at the local level according to rules which are established and accepted by the various actors. These rules span legal, socio-cultural and biophysical dimensions. Effective protection of water resources also means that technical measures are implemented to conserve and protect catchments, in order to ensure the quality and quantity of water and the recharge of groundwater bodies. These measures are defined for different zones. Three categories of zones are established each with its specific restrictions and recommendations. They are covered in a municipal decree which is published by the town councils. A first zone of 1000 m^2 directly upstream of the water source is brought under the jurisdiction of the state, then fenced, reforested and completely protected from human activities. In a second zone covering a minimum of 5 ha upstream of the source, restrictions to the use of the terrain apply, notably with regard to defecation, free-range livestock farming and other harmful human activities, in order to protect the soil - and thus water quality. The land is managed so as to guarantee good conservation of the soil by reforestation with different varieties of fruit trees and softwood lumber. A third zone can be established if supported by the community, with restrictions on burning and free-range grazing, as well as other methods of preserving the soil and managing the vegetative cover. This latter zone can cover the whole catchment, and is meant to promote groundwater recharge. The restoration of the catchment by the delimitation of the zones and the implementation of SLM technologies includes different techniques such as vegetative barriers and stone walls. The restrictions on the use of zone two (see above) do not necessarily conflict with the interests of the producers. For example rainfed crops are unreliable due to the climate and forestry is a better alternative. Therefore people perceive the reforestation of their land as development of their heritage, and as a profitable investment for the long term. In the first two years, a total maximum grant of 400 USD per ha are paid to the producers in tranches, depending on the sustained performance of their conservation activities. These experiences have led to the establishment of national standards on the protection of drinking water sources.

LOCATION



Location: Municipalities of Petit-Goâve, Verrettes, Savanette and Lachapelle, Artibonite, Central West, Haiti

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites
- -72.46513, 19.03449
- -72.85455, 18.37256

Spread of the Technology: applied at specific points/ concentrated in a small area

Date of implementation: less than 10 years ago (recently)

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

HELVETAS Swiss Intercooperation



Erosion control (in zone 3) (HELVETAS Swiss Intercooperation).



Physical protection of an intake point (in zone 1) (HELVETAS Swiss Intercooperation).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Grazing land - Main animal species and products: Cattle, young goats
Extensive grazing land: Ranching



Forest/ woodlands - (Semi-)natural forests/ woodlands: Selective felling
Products and services: Timber, Fuelwood
Tree plantation, afforestation: Mixed varieties

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology: Some zones were cultivated with annual crops and were subsequently transformed into protected zones, where selective felling of trees is only authorized if continuation of natural regeneration is guaranteed, and if the vegetation cover provides effective soil protection.
Livestock density: n.a.

Purpose related to land degradation

- ✓ prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying, Wo: offsite degradation effects



biological degradation - Bc: reduction of vegetation cover, Bf: detrimental effects of fires



water degradation - Hg: change in groundwater/aquifer level, Hq: decline of groundwater quality

SLM group

- improved ground/ vegetation cover
- cross-slope measure
- groundwater management

SLM measures



vegetative measures - V1: Tree and shrub cover



structural measures - S1: Terraces, S2: Bunds, banks, S6: Walls, barriers, palisades, fences



management measures - M1: Change of land use type

TECHNICAL DRAWING

Technical specifications

Three protection zones:

Zone 1: 1000 m², public property, prohibition of any activity;

Zone 2: 50000 m², private property designated to forestry/ agro-forestry and protected by soil protection measures. Prohibition on housing, livestock farming, chemical fertilization, latrines, waste disposal, burning, etc.

Zone 3: all areas in the catchment upstream of zone 2, depending on agreements with the land owners and farmers, oriented towards agroforestry and protected by Sustainable Land Management measures.

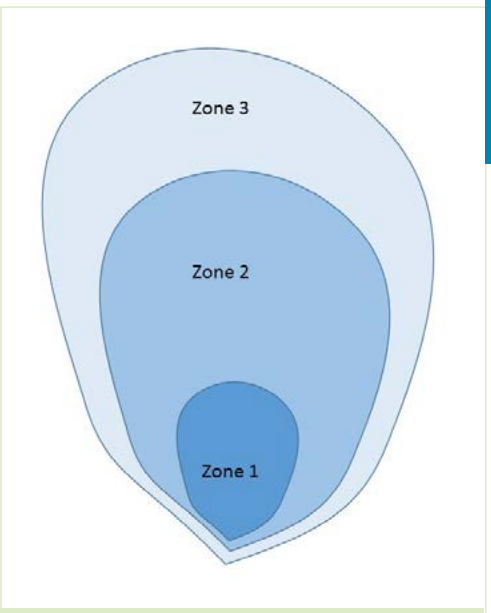


Figure: HELVETAS Swiss Intercooperation Haiti

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **from 0.1 to 5 ha (reference unit 1 ha)**)
- Currency used for cost calculation: **US Dollars**
- Average wage cost of hired labour per day: USD 5

Most important factors affecting the costs

The maintenance operations depend on the climatic conditions (in particular heavy rainfall) and on the type and quantity of structural measures. The topography and geomorphology influence the stability of the structures and hence the maintenance. The maintenance costs are met by the farmers, or in certain cases by the committee responsible for the provision of drinking water. The control on the restrictions of use of the protected zones is carried out by the local authorities together with the above committee. Hence, the costs are distributed over the community funds and the water services.

Establishment activities

1. Discussion on legal provisions with the different actors (Management; To be finalised in the dry period)
2. Elaboration of a municipal decree (Other measures)
3. Acquisition of zone 1 (Other measures)
4. Fencing of zone 1 (Structural)
5. Development of the land plots in zones 1 and 2 (Structural)
6. Treatment of the gullies (Structural)
7. Training of farmers about the conservation practices (Management)
8. Afforestation (Vegetative)
9. Maintenance of the physical structures (Structural)
10. Monitoring and inspection (Management)livestock shed for each house (Structural)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Afforestation, gully correction, laying-out, fencing	1 ha	1	1800	1800	100
Equipment					
Construction material		1	80	80	
Plant material					
Seedlings (lump sum for grass and bushes for slope stabilisation)	average per site	1	100	100	
Construction material					
Cement, iron, PVC, piles	average per site	1	200	200	
Other					
Acquisition of zone 1 (1000 m²)	lump sum	1	300	300	
Rehabilitation and legalization (zone 1)	site	1	200	200	
Total costs for establishment of the Technology				**2680 USD**	

Maintenance activities

1. Maintenance of physical structures (dry stone walls, etc.) (Structural; after the rainy seasons - twice per year)
2. Control and monitoring of the zoning regulation (the municipal decree) (Management)

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
House repairs	1 ha	5	5	25	100
Total costs for maintenance of the Technology				**25 USD**	

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [x] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone

- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

Average annual rainfall in mm: 1500
Very variable between the regions of the country (from 500 to 3000 mm and more)

Slope

- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [x] hilly (16-30%)
- [x] steep (31-60%)
- [ ] very steep (>60%)

Landform

- [ ] plateau/ plains
- [ ] ridges
- [x] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude

- [ ] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [x] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [x] concave situations
- [ ] not relevant

Soil depth

- [ ] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content

- [x] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table

- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water

- [x] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)

- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?

- [ ] yes
- [x] no

Occurrence of flooding

- [ ] yes
- [x] no

Species diversity

- [ ] high
- [x] medium
- [ ] low

Habitat diversity

- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation

- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income

- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth

- [x] very poor
- [ ] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation

- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic

- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups

- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender

- [x] women
- [x] men

Age

- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [ ] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓						good
education	poor	✓						good
technical assistance	poor	✓						good
employment (e.g. off-farm)	poor	✓						good
markets	poor	✓						good
energy	poor	✓						good
roads and transport	poor	✓						good
drinking water and sanitation	poor		✓					good
financial services	poor	✓						good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

drinking water availability	decreased						✓	increased
drinking water quality	decreased					✓		increased
water availability for livestock	decreased					✓		increased

Before SLM: No facility for water extraction.
After SLM: Water extracted from protected source.
Comment: Extraction and conveyance of water.

Before SLM: Contamination by human activities.
After SLM: Decreasing contamination according to the monitoring of behavior.
Comment: Defecation in the open is practiced by half of the households in the rural areas. The restrictions on access of the protected zones must be accompanied by raising awareness on hygiene and by improving the availability of sanitation services.

Socio-cultural impacts

health situation	worsened					✓		improved
land use/ water rights	worsened					✓		improved

Comment: The zoning and bio-engineering measures improve the water quality, which diminishes problems related to fecal contamination etc.

Comment: The zoning and bio-engineering measures improve the water quality, which reduces problems related to water rights, considering that water is a limited resource and is often disputed.

Ecological impacts

surface runoff	increased						✓	decreased
groundwater table/ aquifer	lowered					✓		recharged
soil loss	increased						✓	decreased
landslides/ debris flows	increased					✓		decreased
drought impacts	increased					✓		decreased
impacts of cyclones, rainstorms	increased					✓		decreased
fire risk	increased					✓		decreased

Comment: Increase of infiltration, reduction of runoff and surface erosion, which conserves soil fertility.

Before SLM: High surface runoff.
After SLM: Improved recharge.
Comment: Increase of infiltration and hence recharge of the groundwater table.

Comment: Reduction of erosion by surface runoff.

Comment: Better infiltration and controlled deviation of surface runoff, which diminishes the risk of landslides.

Comment: Increase in soil moisture and recharge of the groundwater table, which diminishes the impact of droughts.

Comment: The measures diminishes the effects of storms and heavy rainfall events by a reduction of surface erosion and more controlled drainage of water in the gullies, which are stabilised by walls and vegetative barriers.

Before SLM: burning practices.
After SLM: elimination of burning practice.
Comment: Certain bio-engineering measures such as dry stone walls or vegetative barriers can limit the propagation of fires.

Off-site impacts

downstream flooding (undesired)	increased					✓		reduced
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced					✓		improved

Comment: Surface runoff and discharge upstream reduce the risk of flooding downstream.

Comment: The conservation of soils and woodland in the protected zones reduces and delays surface runoff, and hence flood events are less intense. Yet, the area covered by protection measures is still insufficient to manage flood risks.

Benefits compared with establishment costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

seasonal rainfall increase	not well at all	✓	very well	Season: wet/ rainy season

Climate-related extremes (disasters)

extra-tropical cyclone	not well at all	✓	very well
drought	not well at all	✓	very well
flash flood	not well at all	✓	very well
landslide	not well at all	✓	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- ✓ 10-50%
- more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ✓ 0-10%
- 10-50%
- 50-90%
- 90-100%

Number of households and/ or area covered

Protection of 34 sources; 27 ha in zone 1 have been fenced and afforested, 281 ha in zone 2 have been afforested and protected. More than 500 farmers were trained to implement and reproduce the various protection measures.

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- The farmers are supported to implement a cost-effective forestry practice to replace a very vulnerable rainfed agricultural production system. But the population in the downstream part of the catchment greatly benefit from the protection of the sources, since the quality and quantity of the water is improving. Therefore an equilibrium must be found between the two groups, in order to ensure that both benefit. The water services can be profitable, and hence encourage participation in the efforts of protection upstream in the catchment, by supporting the producers and/or by financing jobs for the protection of land and water.
- The protection of water resources increases the value of the common heritage and therefore calls for community-based management.

Key resource person's view

- On the basis of the vulnerability of the population and the environment in the rural environment of Haiti, the protection of water resources should be established to guarantee secure and profitable use of water. The participatory methods implemented allow for the creation of a supportive environment, suitable for a community-based effort for local rural development. These mechanisms inspire a culture of citizenship in a local democratic context under development.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- The management of state land in zone 1 poses a challenge because this land has to be integrated into the property of the state. The purchase or compensation of these lots can require a long negotiation between the local authorities and the owners. → *It is important that the local actors resolve these matters among themselves, and that there is no interference from a project, in order not to distort the negotiation.*

Key resource person's view

- The sustainability of the measures and the cost of maintenance are largely dependent on the quality of the measures. → *Ensure good technical instruction and follow-up on-site by trained staff.*

REFERENCES

Compiler: Antoine Kocher - antoine.kocher@helvetas.org
Resource persons: Antoine Kocher (antoine.kocher@helvetas.org)
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_583/
Linked SLM data: SLM Approach: Concertation locale pour la protection des sources d'eau https://qcat.wocat.net/en/wocat/approaches/view/approaches_1764/
Documentation was facilitated by: HELVETAS Swiss Intercooperation

Links to relevant information which is available online
Drink water and think of the source (long version): https://assets.helvetas.org/downloads/capex_hsi_protection_des_source_vlongue.pdf
Drink water and think of the source (short version): https://assets.helvetas.org/downloads/ capex_hsi_protection_des_sources_vcourte.pdf



Land management to protect hillslopes (HELVETAS Swiss Intercooperation Haiti).

Local consultation for action on hillsides to protect water resources (Haiti)

DESCRIPTION

Consultation between stakeholders for natural resource management involves communities, authorities and other actors in collective decision-making. This is often to protect water supplies, and simultaneously to institutionalise sustainable management of these common resources.

The management of natural resources for drinking water supplies in the rural zones of Haiti is addressed at the catchment scale, by bringing together stakeholders who are closest to the area. The principle of integrated resource management is followed by involving all actors. Three pillars of action are set up: integrated management, local ownership and the so-called 'zoning approach'. The overall approach is a combination of measures to drive and influence attitudes and actions in land use, and of measures for restoration and monitoring. Together, these lead to an ongoing mechanism of 'ownership for sustainable management'. Driving attitudes and actions is a participatory process which enables identification of the actors, assists in the understanding of issues, helps construct a vision of community-based resource management and builds trust. The changes in attitudes and actions comprises a set of measures aimed at maintaining law abidance and encouraging community decisions. The local authorities are responsible for applying these measures, and for negotiations with the community. In particular, a municipal decree is issued to guarantee the protection of the catchment areas upstream of the water resources in order to protect the quality of the water distributed. The measures for restoration are aimed at promoting the environmental quality of the catchment, and its capacity to preserve water resources through maintaining vegetation cover and soil health. Finally, monitoring covers maintenance of the protected area, and assesses the impact of the measures on the resources. Through feedback it helps to maintain commitment from the communities. The 'zoning approach' consists of defining the areas to be protected upstream of the water resources. For these areas, different restrictions on use are determined, based on extended and supervised consultation, with the aim of protecting the quality and recharge of groundwater. Two of the three zones are defined, based on the negotiations; zone 1 protects the abstraction of water, zone 1 is dedicated to protecting water quality, and zone 3 is the area that maintains or helps regenerate suitable environmental conditions for recharge. Support is given to help local actors in implementing the different phases of the process, through organised training and meetings. The civil society (water management committee consisting of farmers and local residents), the private sector (technicians and nursery owners) and the local authorities (mayor, Councils of Administration and Municipal Sections/ CASEC) jointly define the conditions and the methods for protection and control. A municipal decree formalises the restrictions on land use, by declaring the principles of protection which are imposed or recommended, and the possible penalties in case of breach of rules. Although the area directly surrounding the water resource is officially owned by the Haitian state, its use by farmers and the presence of voodoo deities (spirits) require that the negotiations on the restriction of its use and on ownership rights are conducted with caution. The local communities participate in the measures for protection and regeneration as an in kind contribution to the project. The farmers who change their land use receive a payment for environmental services according to the success of their afforestation efforts. This grant is paid in several stages, from the planting of the trees to full establishment two years afterwards.

LOCATION



Location: Artibonite, Central West, Haiti

Geo-reference of selected sites
- -72.47063, 19.03486

Initiation date: 2008

Type of Approach
- ☐ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based

HELVETAS Swiss Intercooperation



Inspection of protection infrastructure by the water management committee (HELVETAS Swiss Intercooperation Haiti).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The approach consists in raising awareness among the population about the threats to the availability and quality of water resources, and in stimulating a response for the sustainable management of these. The initiative and decision-making must be carried by local actors, which is why the approach is, in essence, both participatory and inclusive. Problems can include access to the water resources, issues of land ownership, and religious traditions. These pose significant potential for conflict and must be managed from the start, through principles of transparency and accountability. Therefore, the stakeholders are trained to master the competences required for these negotiations.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **institutional setting:** The communities have the rights to manage their land and water resources, and in this regard can engage in processes for protection.
- **collaboration/ coordination of actors:** 'Ownership' by the local actors with regard to initiatives to protect the water resources is a fundamental precondition for sustainability.
- **legal framework (land tenure, land and water use rights):** The constitution stipulates that the land surrounding water resources is owned by the state. However, this law is not reflected in practice, and the municipalities must establish decrees to specify the terms of protection and penalties applicable. The actual land use practices do not sufficiently encourage users without land title to implement sustainable protection measures as there is no legal obligation.
- **knowledge about SLM, access to technical support:** The competences required are learned on site by the water service management committees and among the technical agents of the municipal sections. The adoption of the management techniques by the land users promotes the sustainability and upscaling of measures.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The voodoo deities (spirits in which people traditionally believe) are considered to be aquatic and to reside in the water resources. Therefore an arrangement must be found which allows maintenance of religious practices while at the same time protecting the water. The hindrance is that voodooism is often hidden, and followers are not always receptive to expressing their needs.
- **availability/ access to financial resources and services:** The modification of agricultural practices in the protected zones, where land use changes from rainfed annual cropping to forestry, impacts on income. This needs be compensated for by financial support in the initial period when there are no returns from planting trees - when farmers used to benefit from annual cropping.
- **institutional setting:** The institutions are weak and need technical and financial support.
- **policies:** The fragile political situation in Haiti influences the legitimacy of the local authorities, and their capacity to assemble the population.
- **land governance (decision-making, implementation and enforcement):** The absence of a land register, and land fragmentation in particular, weakens the potential for land management.
- **knowledge about SLM, access to technical support:** Difficulties for the administrations of the municipal sections to recruit and maintain staff. The rotation of members within the water service management committees - due to the election of members for three years affects the availability of competence for land management and supervision.
- **workload, availability of manpower:** The protection measures proposed for the catchments require a significant amount of labour, and do not immediately yield direct profitability. Also, the difference between the efforts put in by the population in the upstream part of the catchment, and the benefits yielded by the population downstream part, is not easily reconciled.

Payments for ecosystem services are required as compensation.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (farmers, land owners, other land users and local residents) participate in discussions on issues of sustainability of the resources, decision-making and engagement to modify practices:** also in delineation of the zones to protect.
- **community-based organisations (Management committee for water services):** Community mobilisation, information, participating in discussions on the protection of the water resources, definition of protected areas, supervision and monitoring.
- **SLM specialists/ agricultural advisers (Technical agents):** Assist the local authorities in controlling restrictions of use and support the water service management committees and farmers in the implementation, maintenance and monitoring of measures for protection and regeneration.
- **NGO (The project team):** Supports the actors in the process, provides training, offers financial support, monitors the implementation using criteria of eligibility and equity.
- **private sector (Owners of nurseries and technicians):** Provide seedlings necessary for afforestation, support and supervise the farmers in the implementation of protection measures, and transfer knowledge with support from technical agents.
- **local government (The Councils of Administration of the Municipal Sections (CASEC) and the municipal authorities):** The former engage the population in the issues of resource protection and sustainable development; the latter engage in negotiations on land and restrictions on land use, and issue municipal decrees.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation			✓		
monitoring/ evaluation			✓		

Specify who was involved and describe activities

The farmers and the communities are made aware of issues about the sustainable management of natural resources. Then they are supported in discussions on the protected areas in order to establish the arguments required for negotiation with the local authorities.

The protection measures for the hillslopes and gullies, the barriers in zone 1 and the afforestation works arefinanced by the project, and implemented by the local communities and the farmers as an in kind contribution.

The principle of payment for ecosystem services is to pay the farmers in several tranches, in order to ensure good growth of the replanted trees and to make the afforestation successful. The farmers receive a grant for each seedling that establishes successfully.

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- ✓ personal experience and opinions (undocumented)

Comment: The farmers decide on the species to use for the afforestation, but the Sustainable Land Management specialists guide them in identifying the conservation techniques which are most suitable for the terrain. The principle of zoning applies to the areas, which were negotiated with the farmers, but the restrictions for use remain the same regardless of the zone.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- ✓ Research

Capacity building/ training

Training was provided to the following stakeholders

- ✓ land users
- ✓ field staff/ advisers

Form of training

- ✓ on-the-job
- ✓ farmer-to-farmer
- ✓ demonstration areas
- ✓ public meetings
- courses

Subjects covered

Soil protection techniques: construction of stone walls, terraces, vegetated barriers, contour ditches. Forest management, environmental vulnerability, control of slash-and-burn, conflict management, monitoring methods, principles of good governance by management committees.

Advisory service

Advisory service was provided

- [ ] on land users' fields
- [x] at permanent centres

Comment: Support is provided by the Municipal Agricultural Agency (permanent centres) in order to enable the specialist responsible to know and support the process of land use change and the development of agricultural practices.

Institution strengthening

Institutions have been strengthened/ established

- [ ] no
- [ ] yes, a little
- [ ] yes, moderately
- [x] yes, greatly

at the following level

- [x] local
- [ ] regional
- [ ] national

Type of support

- [ ] financial
- [x] capacity building/ training
- [x] equipment

Describe institution, roles and responsibilities, members, etc.

The Committee for Drinking Water supply and Sanitation (CAEPA), which is in charge of the local water service, is the main institutional partner. Close guidance enables improvement of management skills, and the representation of the population, as well as transparency and efficiency, which will ensure the sustainability of the service.

The Councils of Administration of the Municipal Sections (CASEC) are the local elected officials who are represented in the CAEPA. They receive training to support the CAEPA in providing public service and in local governance.

The Municipal Technicians for Drinking Water and Sanitation (TEPAC) are sent on a temporary assignment by the Directorate of Drinking Water and Sanitation. They verify and support the quality and functionality of the service for water and sanitation in their municipalities. They are the direct partners of the CAEPA and benefit from local support to improve their capacities. In this way many activities of training and support facilitate their integration at local level, and their acceptance by the local actors. The Municipal Agricultural Agencies (BAC) represent the Ministry of Agriculture at the local level. They make a local specialist available for the farmers to improve the production. These specialists are closely involved in the implementation of projects; they benefit from training and integrate the experience and knowledge gained in their institutions.

Monitoring and evaluation

The monitoring of the overall system covers the functionality of the water service, the protection of water resources for maintaining the required quality and flows, as well as the relationships involving collaboration and information exchange between the local authorities, the technical services and the relationships with the centralised institutions. The monitoring is therefore distributed over the TEPAC, the CAEPA and the technical assistance related to the CASEC.

Research

Research treated the following topics: health and nutrition aspects

- [x] sociology
- [x] economics/ marketing
- [ ] ecology
- [x] technology

Comment: Socio-environmental research allows the assessment of the feasibility of projects in the upstream part of the catchment. They increase the knowledge about local social and demographic aspects, and of the environmental conditions and the impacts of changes in the use of natural resources. This allows identification and minimisation of risks of conflict or environmental damage. Economic research deepens the capacity of self-reliance of the system, and assesses in this way the potential for economic sustainability.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [ ] 2000-10000
- [x] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Precise annual budget: n.a

Major donor: This approach is implemented in projects financed by own funds, by the Swiss Cooperation or by the 'Chain of Happiness'.

The following services or incentives have been provided to land users

- [x] Financial/ material support provided to land users
- [x] Subsidies for specific inputs
- [ ] Credit
- [x] Other incentives or instruments

Financial/ material support provided to land users

Depending on the cases, intensive labour may be required to construct the physical structures to protect the catchments. A transition to more sustainable maintenance systems must be initiated to make sure that the producers benefit from these works, and will maintain the structures. An important support for the implementation of the approach is the payment for ecosystem services. The land use change required for the protection of the water resources generates a change in the economic model, which pushes the farmers from a system of annual production towards a system of agroforestry, under which returns are only gained in the long term. Due to the vulnerability of the rural population of Haiti, this change is only possible if compensation covers the deficits incurred in the short and intermediate term. Thus, the establishment of payments for ecosystem services rewards the work for afforestation depending on the survival of the seedlings in the first two years. After this period, the trees are well-established.

Subsidies for specific inputs (including labour)

Labour by land users was

- ☐ voluntary
- ☐ food-for-work
- ☑ paid in cash
- ☐ rewarded with other material support

	partly financed	fully financed
labour *Intensive labor with a contribution required from the land owners and land users.*	☑	☐
equipment: tools *Hand tools are provided for the construction of physical structures.*	☐	☑

Other incentives or instruments

A municipal decree is issued in order to define the rules for protection, and as such, promotes measures for the protection of soils and water resources. The approach is accepted as its was elaborated with the inclusion of all relevant stakeholder groups in a participatory manner. It is respected as the decree is legally binding and penalties might apply in case of disregard.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *The participatory approach for the management of resources initiates a transparent and inclusive dynamic, which contributes to building citizenship and in this way strengthens the democratic process and the willingness to participate.*	☐	☐	☑	☐
Did the Approach help land users to implement and maintain SLM Technologies? *The adoption of the management and protection techniques by the farmers is fostered by involving them from the start, in the analysis and the understanding of the issues related to the natural resources, and in the decision-making on the application of the measures.*	☐	☐	☐	☑
Did the Approach improve coordination and cost-effective implementation of SLM? *Particularly on the mid- and long run the implemented protection measures and the increasing scale of interventions present an attractive cost-benefit ratio. With time the benefits i.e. the protection function of the growing vegetation become even more relevant.*	☐	☑	☐	☐
Did the Approach improve knowledge and capacities of land users to implement SLM? *A lot of knowledge on the functioning of the environment and on protection techniques was new for the farmers.*	☐	☐	☐	☑
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *The collaboration between the local actors can be achieved through the management of local resources, since these are of concern and interest for everyone.*	☐	☐	☐	☑
Did the Approach mitigate conflicts? *Several potential or latent conflicts were mitigated or solved due to the arrangement of dialogue and by negotiations. However, cases remain which present risks by the vulnerability of the water resources and the insecurity of land tenure.*	☐	☐	☑	☐
Did the Approach empower socially and economically disadvantaged groups? *Particularly vulnerable farmers with degraded land and limited water resources benefited from the interventions around the protected sources in the upper watersheds.*	☐	☐	☑	☐
Did the Approach encourage young people/ the next generation of land users to engage in SLM?	☐	☐	☑	☐
Did the Approach improve issues of land tenure/ user rights that hindered implementation of SLM Technologies? *The decisions on land tenure issues, which were taken after the negotiations, were ratified by the formalisation of land ownership status.*	☐	☐	☑	☐
Did the Approach lead to improved access to water and sanitation? *The improved quality and quantity of the water resources are a direct result of the approach.*	☐	☐	☐	☑
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? *The soil protection measures confer better climate resilience in the landscape by diminishing the risk of disasters, and the land use changes reduce the dependency of farmers on variations in seasonal rainfall.*	☐	☐	☑	☐
Did the Approach lead to employment, income opportunities? *The intensive labour and the payments for ecosystem services have created temporary jobs. But the operation of monitoring and control and the new agroforestry practices are undertakings on the long term, which depend on the strength of the management.*	☐	☐	☑	☐

Main motivation of land users to implement SLM

- [ ] increased production
- [x] increased profit(ability), improved cost-benefit-ratio
- [x] reduced land degradation
- [x] reduced risk of disasters
- [ ] reduced workload
- [x] payments/ subsidies
- [x] rules and regulations (fines)/ enforcement
- [x] prestige, social pressure/ social cohesion
- [x] affiliation to movement/ project/ group/ networks
- [x] environmental consciousness
- [ ] customs and beliefs, morals
- [x] enhanced SLM knowledge and skills
- [ ] aesthetic improvement
- [x] conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- [ ] no
- [ ] yes
- [x] uncertain

Comment: The technicians related to the CASEC cannot be paid by the state, and their role of monitoring can be threatened if they are not supported by the town council. Therefore, the role of the CAEPA remains functional depending on the success of the water service. The latter is therefore a precondition for the protection of water resources upstream in the catchment. But the farmers who implemented agroforestry systems in the protected zones have good results.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Improved profitability in case of prior difficulties with rainfed crops.
- Improved agricultural techniques and sustainability of the enterprises through sustainable exploitation of the water resources.
- Access to paid work.

Key resource person's view

- Fostering of community processes and of collective and inclusive decision-making.
- Integration of principles of good governance for the management of local water resources.
- Uptake of environmental conservation practices in the local communities and potential for upscaling. Improvement of bacterial quality of the water and prevention of risks of depletion by the improvement and preservation of groundwater recharge.
- Adaptation to climate change and risk prevention in case of catastrophe, by securing access to drinking water.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Some farmers must hand over part of their land or modify their practices, which can cause social and family conflicts. → *Open discussions and transparency in the process build trust. The negotiations must take place between peers, and the project should not interfere. If the resistance is too strong, it is better not to continue. Payment for ecosystem services is also important in this context, and should be included in the discussion with the local stakeholders.*

Key resource person's view

- The method requires skillful coaching, and the project team must withdraw from the key stages of the discussions in the communities. These competences, which determine the success of the approach, are difficult to master. The risk of a lack of ownership is important, especially due to the upscaling of the projects in the rural zones. The people get used to the projects and consider these as external initiatives, from which they take advantage without necessarily sharing the common objectives. → *Understanding the needs of the communities is essential, and supporting them in their own choices. This requires experienced human resources and a culture of joint action with the project.*

REFERENCES

Compiler: Antoine Kocher - antoine.kocher@helvetas.org
Resource persons: Antoine Kocher (antoine.kocher@helvetas.org) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_1764
Linked SLM data: WOCAT SLM Technology: Protection of water resources https://qcat.wocat.net/en/wocat/technologies/view/technologies_583/
Documentation was facilitated by: HELVETAS Swiss Intercooperation

Key references

Links to relevant information which is available online:

Boire l'eau et penser à la source. Documentation of experience on the protection of water resources: https://assets.helvetas.org/downloads/capex_hsi_protection_des_source_vlongue.pdf

La protection des sources: https://assets.helvetas.org/downloads/capex_hsi_protection_des_sources_vcourte.pdf

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami				✓	
Landslide	✓				
Tropical cyclone		✓			
Drought	✓	✓			
Wildfire		✓			
Biological hazards					
Epidemics (Humans)	✓				
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

Exposure			**Comment:**
of people	very high/ strong	very low/ non-existent	
of private assets	very high/ strong	very low/ non-existent	
of community land	very high/ strong	very low/ non-existent	
of community infrastructure	very high/ strong	very low/ non-existent	*More than 50% of the sources present anthropogenic bacterial contamination.*
Economic factors			
Access to markets	very high/ strong	very low/ non-existent	
Income	very high/ strong	very low/ non-existent	
Diversification of income	very high/ strong	very low/ non-existent	
Savings/stocks	very high/ strong	very low/ non-existent	
Bank savings/remittances	very high/ strong	very low/ non-existent	
Degree insurance coverage	very high/ strong	very low/ non-existent	
Social factors			
Literacy rate	very high/ strong	very low/ non-existent	
Government support	very high/ strong	very low/ non-existent	
Family support	very high/ strong	very low/ non-existent	
Community support	very high/ strong	very low/ non-existent	
Access to public services	very high/ strong	very low/ non-existent	
Physical factors			
Robustness of houses	very high/ strong	very low/ non-existent	
Robustness of infrastructure	very high/ strong	very low/ non-existent	
Other vulnerability factors			
Environmental degradation and production conditions	very high/ strong	very low/ non-existent	
Diversification of agricultural production	very high/ strong	very low/ non-existent	
Rates of malnutrition	very high/ strong	very low/ non-existent	

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- [x] substantial increase in losses
- [x] some increase in losses
- [ ] no change
- [ ] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[x] 0	[x] 0
[ ] 1	[ ] 1
[ ] 2-5	[ ] 2-5
[ ] 6-10	[ ] 6-10
[ ] 11-50	[ ] 11-50
[ ] > 50	[ ] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[ ] 11-50	[ ] 11-50
[ ] 51-100	[ ] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[x] > 500	[x] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[x] 1-20%	[x] 1-20%
[ ] 21-50%	[ ] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[x] 21-50%	[x] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[ ] 0 USD	[ ] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[x] 1001-5000 USD	[ ] 1001-5000 USD
[ ] 5001-10'000 USD	[x] 5001-10'000 USD
[ ] 10'001-50'000 USD	[ ] 10'001-50'000 USD
[ ] 50'000-250'000 USD	[ ] 50'000-250'000 USD
[ ] > 250'000 USD	[ ] > 250'000 USD

Duration since last disaster

- [ ] < 3 months
- [ ] 3-6 months
- [x] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Technology

The approach and the technique put in place for the protection of sources are mainly aimed at protecting water quality in order to minimize the risk of bacterial contamination, in a context where the prevalence of water-borne diseases, including cholera, is high. This approach, which involves a series of technologies, further reduces the risk of drying out of sources, increasing the recharge potential, and hence preventing the consequences of rainfall variations. Soil protection measures in the watershed also reduce erosion, prevent, and mitigate the risk of soil and infrastructure degradation, such as debris or debris flows, during periods of flooding. Mechanical structures such as barriers, terraces, contour channels, must be maintained until the vegetation is strong enough to protect against run-off erosion.

IMPACTS

Additional benefits of the Technology

Safety (on-site)				**Comment:**
Safety of people	decreased		increased	
Economic goods (on-site)				
Safety of water stocks	decreased		increased	*The quantification of improvements in flows and water quality remains variable and difficult to describe. Nevertheless, the populations report a stabilization of flows.*

Off-site impacts

Groundwater recharge and protection also of areas lying lower / behind the water source.



Fishbone shaped ditches ready to be filled with fascine bundles before being covered with soil (Helen Gambon, Swiss Red Cross).

Drainage fascines (Honduras)

DESCRIPTION

Fascine drains are used to drain excess water from elevated lands that might otherwise affect land or houses below as surface runoff. They help prevent landslides and gully formation.

The Department of Olancho is a rainforest area located in the mountain range area of Cordillera Central and Sierra de Agalta, at an average altitude of 1,500 masl. Though most of Olancho is protected as a natural reserve or natural park, there are high levels of deforestation resulting from livestock keeping and intense industrial forest management practices. However, small-scale farmers also cause deforestation. These practices result in forest fires, soil degradation and erosion. The Department of Olancho is regularly affected by tropical storms and hurricanes coming in from the Atlantic. This combination of adverse natural phenomena, topographic exposure and harmful use of natural resources causes significant material damage and even human deaths. Fascine drains are used to remove excess water from slopes that affect lands or houses in lower areas. The technology helps prevent landslides and gullies. Fascine drains are implemented by digging lateral ditches in a fishbone formation connecting to a main central drain. The system is generally built from the bottom of the hill, working upslope. The trenches are filled with 'fascine bundles' namely bunches of grass, such as King Grass (*Pennisetum sp.*) or sugar cane (*Saccharum officinarum*). These plants are fixed in place with cuttings of trees that regenerate vegetatively, such as madriado (*Gliricidia sepium*). Then, soil is added. Since the livestock can damage the fascine bundles and the sprouting cuttings, the area must be fenced off. To avoid production losses, grass is sown (maralfalfa or King Grass) on top of the fascines. These grasses can be cut three times a year and used as fodder. This technology may be combined with others, such as live fences using vetiver grass (*Vetiveria zizanioides*). In this case study, the fascine drains were implemented by the Project "Resiliencia" undertaken by the Swiss/Honduran Red Cross. This project aims at providing sustainable support to enhance resilience in rural areas in Olancho by reducing disaster risks and promoting health at different levels (household, community, municipality). Bioengineering measures, such as fascine drains, are implemented in areas which were identified as vulnerable and exposed by risk assessments.

LOCATION



Location: Dulce Nombre de Culmí municipality, Río Blanco community, Departament of Olancho, Honduras

No. of Technology sites analysed: single site

Geo-reference of selected sites
• -85.58228, 15.16825

Spread of the Technology: evenly spread over an area (approx. < 0.1 km² (10 ha))

Date of implementation: 2007

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

Swiss Red Cross

Cruz Roja Hondureña



Fascine drains covered with Maralfalfa grasses - a fodder that can be cut and fed to livestock (Helen Gambon, Swiss Red Cross).



The slope on which the fascines have been implemented behind this house has been closed with a fence to impede the entrance of livestock (Helen Gambon, Swiss Red Cross).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact

Land use



Grazing land - Main animal species and products: Cow Grasses
Intensive grazing/ fodder production: Cut-and-carry/ zero grazing

Comment: No animals should be allowed into areas where fascine drains are built to prevent them from damaging the structures. The vegetation (grass) is cut for the cattle. However, the animals can freely roam on the rest of the farm lands.

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 3
Land use before implementation of the Technology: Before the technology was implemented, the area was used for extensive grazing.
Livestock density: n.a.

Purpose related to land degradation

- ✓ prevent land degradation
- reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wr: riverbank erosion

SLM group

- water diversion and drainage

SLM measures



vegetative measures - V2: Grasses and perennial herbaceous plants



structural measures - S3: Graded ditches, channels, waterways



management measures - M2: Change of management/ intensity level

TECHNICAL DRAWING

Technical specifications

The system involves digging ditches in a fishbone formation connected to a main central drain. Central drains generally are 50 cm deep and lateral ditches are 30 cm deep. The drains are generally built starting from the bottom of the slope moving upwards. The lateral ditches are generally 1.0 to 2.5 metres apart, built in parallel, at an angle from the main drain, with lengths varying between 3 and 8 metres. Trenches are filled with bundles of species such as Maralfalfa grass (*Pennisetum sp.*), King Grass (*Pennisetum sp.*) or sugar cane (*Saccharum Offcinarum*). These are then pinned down with 70 cm stakes from trees that regenerate easily from cuttings, eg. Madriado (*Gliricidia sepium*). The drains are oversown with fodder species. The area must be fenced off to prevent livestock from damaging the bundles and the sprouting stakes and grasses.

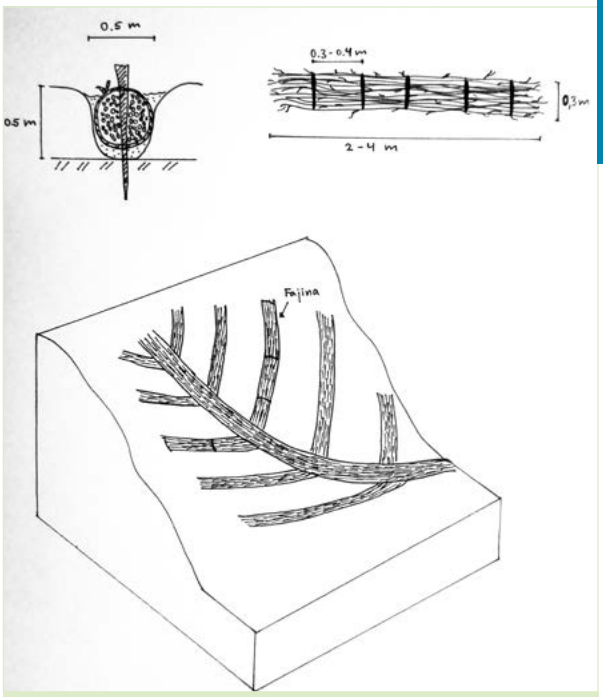


Figure: Helen Gambon, Swiss Red Cross Shahidul Islam

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **one fascine drainage system** volume, length: 40m x 40m)
- Currency used for cost calculation: **Lempiras**
- Exchange rate (to USD): 1 USD = 21.0 Lempiras.
- Average wage cost of hired labour per day: 150 Lempiras.

Most important factors affecting the costs

Purchase and transportation of plant materials that were not available on site.

Establishment activities

1. Clear land (winter)
2. Prepare stakes and transport them to site
3. Place stakes and wire
4. Prepare plant material (king grass or maralfalfa) and tie them in bunches
5. Dig 50 cm deep trenches (centre) and 30 cm deep ditches (lateral branches) (Structural)
6. Place bundles in trenches and fix with stakes (Structural)
7. Cover with soil (Vegetative)
8. Plant vegetation to cover (Vegetative)

Establishment inputs and costs

maralfalfa, king grass, sugar cane or bamboo	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Trained labor	person/ day	1.0	500	500	
Untrained labor	person/ day	18.0	150	2700	30
Equipment					
shovel, pike, gloves, machete	pieces	3.0	2	6	100
Cord	pound	5.0	25	125	100
Plant material					
maralfalfa, king grass, sugar cane or bamboo	pounds	200.0	2	400	100
wood for stakes	piece	60.0	3	180	100
Construction material					
posts	post	100.0	25	2500	100
barbed wire	roll	1.0	450	450	
Other					
Transportation for plants	trip	1.0	500	500	100
Total costs for establishment of the Technology				**7361 Lempiras**	

Maintenance activities
1. Cut grass with machete (every 4 months)
2. Keep watch on the fence

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Untrained labor	person days	6.0	150	900	100
Total costs for maintenance of the Technology				**900 Lempiras**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [x] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 1400
Dry season from January to June, Rainy Season between June and October, with a hot August.

Slope
- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [x] very steep (>60%)

Landform
- [ ] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [x] concave situations
- [ ] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [ ] yes
- [x] no

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [ ] poor
- [x] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [ ] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [x] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [x] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓	good
education	poor	✓	good
technical assistance	poor	✓	good
employment (e.g. off-farm)	poor	✓	good
markets	poor	✓	good
energy	poor	✓	good
roads and transport	poor	✓	good
drinking water and sanitation	poor	✓	good
financial services	poor	✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

fodder production	decreased	✓	increased
animal production	decreased	✓	increased
workload	increased	✓	decreased

Comment: Land users did not need to reduce livestock to implement the technology, nor were they able to increase numbers.

Socio-cultural impacts

SLM/ land degradation knowledge	reduced	✓	improved

Ecological impacts

surface runoff	increased	✓	decreased
excess water drainage	reduced	✓	improved
soil loss	increased	✓	decreased
nutrient cycling/ recharge	decreased	✓	increased
biomass/ above ground C	decreased	✓	increased
landslides/ debris flows	increased	✓	decreased
impacts of cyclones, rainstorms	increased	✓	decreased

Off-site impacts

damage on neighbours' fields	increased	✓	decreased

Comment: Before implementation, the speed of water flow damaged the plots in the lower areas of the implementation sites. Once the fascine drains were set in place, water now filters into the ground at a higher rate, thus its flow speed has decreased, and the water flows towards the stream in a controlled way.

Benefits compared with establishment costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed	How the Technology copes with these changes/ extremes			
Gradual climate change				
annual temperature increase	not well at all	✓	very well	
seasonal temperature increase	not well at all	✓	very well	Season: summer
seasonal rainfall decrease	not well at all	✓	very well	Season: summer
Climate-related extremes (disasters)				
tropical storm	not well at all	✓	very well	
extra-tropical cyclone	not well at all	✓	very well	
landslide	not well at all	✓	very well	

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [x] single cases/ experimental
- [ ] 1-10%
- [ ] 10-50%
- [ ] more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- [x] 0-10%
- [ ] 10-50%
- [ ] 50-90%
- [ ] 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- The Technology protects houses against running surface water (runoff) and landslides.
- Food is produced for livestock.

Key resource person's view

- The Technology prevents soil loss and gully formation.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Livestock can destroy the fascine drains. → *Area must befenced off and monitored.*

Key resource person's view

- Land users abandon the land due to migration. → *Though migration is common, some family members usually remain behind and they can sustain the SLM Technology.*

REFERENCES

Compiler: Helen Gambon - helen.gambon@redcross.ch

Resource persons: Jorge Alberto Argueta - land user; Nelin Lorena Acosta Granados (claudio.stau er@redcross.ch) - SLM specialist; Carlos Rolando Montes Lobo (claudio.stau er@redcross.ch) - None

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_744/

Linked SLM data: SLM Approach: Participatory slope stabilisation https://qcat.wocat.net/en/wocat/approaches/view/approaches_745/

Documentation was facilitated by: Swiss Red Cross - Switzerland

Key references

Local responses to global challenges - community based Disaster Risk Reduction. Experiences from Honduras. Case Study. Swiss Red Cross, May 2016: info@redcross.ch (free of charge)



Diverse bioengineering measures are combined to stabilise a slope that poses a risk to a house nearby (Helen Gambon, Swiss Red Cross).

Participatory slope stabilisation (Honduras)

Bioingeniería

DESCRIPTION

Bioengineering includes a series of techniques based on the use of living vegetation to protect slopes and embankments from erosion and landslides. Bioengineering measures are designed according to comprehensive risk assessment; they are multi-purpose as a whole, and have low establishment and maintenance costs. They also enhance the capacities of families and communities to mitigate disaster hazards, to enhance health and food security, and to strengthen community organisations also.

To minimise the impact of hazards and, thus, to minimise risk, the Honduran/ Swiss Red Cross uses microprojects to implement specific mitigation measures within the communities where it operates. Green Infrastructure, consisting of a series of techniques based on live vegetation to prevent erosion and landslides on slopes and embankments, plays an important role in the microprojects. Plants are established on the embankments to reinforce the soil with their roots and/ or foliage, thus facilitating drainage and creating barriers to retain sediment. As a whole, bioengineering techniques are multipurpose and incur low construction and maintenance costs. Thus, low-income, vulnerable families can adopt the technologies; these practices also strengthen the capacities of families and communities to prevent or reduce disaster hazards and promote health and food security. Even though bioengineering techniques are implemented through technical assistance provided by the project team, it is not a complicated process and the plants used are generally locally available - thus these measures are easily replicated. Critical sites which are very vulnerable to landslides are identified through a comprehensive risk assessment excersise involving participatory processes that are carried out by a multidisciplinary technical team. Community workshops and home visits are used to raise awareness among the beneficiaries about existing hazards, and beneficiaries receive training on bioengineering techniques, soil conservation, and climate change. Beneficiaries and technicians carry out field visits to previously critical, but now stable sites. This allows beneficiaries to get acquainted with the techniques used and they also benefit from the experience of the person pioneering the bioengineering work. The techniques and materials used are identified together with each beneficiary or, when addressing issues referred to protecting community infrastructure, with local emergency committees, health committees and water management boards. Beneficiaries and community organisations implement bioengineering techniques together with the technical support provided by the Honduran/ Swiss Red Cross. In some cases, the Red Cross also provides materials or transportation for the latter. In most cases, stabilised slopes and embankments are then transformed into sustainable production areas, such as agroecological family orchards or medicinal gardens. Thus, beneficiaries can diversify their diet, and generate income by selling their production surplus. People participate actively in identifying, developing and building bioengineering techniques, and the high level of adoption of the technologies provides evidence of the level of interest and awareness achieved through sensitisation and training. Thus, participatory processes of implementation, under the principle of learning by doing and action-training, result in reduced local hazards and also generate sustainable learning processes enabling the replication of activities and maintenance tasks performed by the community.

LOCATION



Location: Municipalities of Catacamas, Dulce Nombre de Culmí and San Esteban, Departament of Olancho, Honduras
uminabad, Khatlon, Tajikistan

Geo-reference of selected sites
• 85.88562, 14.89701

Initiation date: 2011

Year of termination: n.a

Type of Approach

- traditional/ indigenous
- recent local initiative/ innovative
- ✓ project/ programme based

Swiss Red Cross

Cruz Roja Hondureña



Learning about diverse bioengineering measures that stabilise vulnerable embankments (Helen Gambon, Swiss Red Cross).



A model of bioengineering methods for awareness raising and training purposes (Helen Gambon, Swiss Red Cross).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

To minimise the effects of natural hazards by implementing improved mechanisms addressing these at the community and municipal levels. The impact of hazards and risks is reduced by implementing specific mitigation measures, which empower vulnerable communities by allowing them to replicate these activities.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **institutional setting:** Local Emergency Committees (Comités de Emergencia Local, CODEL) implement bioengineering works to protect community infrastructure (schools, health centres, water infrastructure, evacuation routes) and in most cases they help to implement bioengineering works at the household level.
- **collaboration/ coordination of actors:** The multiple stakeholder approach and working together through alliances facilitates working with different community organisations. This provides improved protection for important community infrastructure such as schools, health units and water systems.
- **legal framework (land tenure, land and water use rights):** Measures can only be implemented on land belonging to land users.
- **knowledge about SLM, access to technical support:** Training on risk management, Sustainable Land Management and climate change as well as the support provided by the technical team helped implementing bioengineering techniques.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **legal framework (land tenure, land and water use rights):** Since the measures can only be implemented on land belonging to land users, implementation is limited to where there is security of tenure.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities/ beneficiaries living in houses threatened by landslide hazards (critical sites):** Stakeholders participate in risk assessment and identification of critical sites. They implement the measures on their plots with help from CODEL and technical support from the Honduran/ Swiss Red Cross.
- **community-based organisations such as CODELs, health committees, water management boards:** CODELs implement bioengineering techniques to protect community infrastructure, coordinating with health committees and water management committees, and the general population, and help to stabilise houses situated on critical sites.
- **NGO (Honduran/ Swiss Red Cross):** Identify critical sites through risk assessment, sensitise and train CODELs and the population, provide technical and material support as needed.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation		✓			
planning				✓	
implementation				✓	
monitoring/ evaluation					✓

Specify who was involved and describe activities

Dissemination of maps displaying risks, provision of training to households and the community, as well as community workshops led by the Honduran/ Swiss Red Cross. A model is created for the community so its people can learn about the different techniques and benefits derived from bioengineerin g (see photo above).

During the planning stage, the project's contribution as well as the community's input is determined. Also, technologies and materials used for the measures are calculated.

Beneficiaries and local emergency committees implement bioengineering works, while Honduran/ Red Cross provides technical and material support.

Land users monitor and perform maintenance tasks on mitigation structures. The project provides the required technical support.

Flow chart

Participatory development process to stabilise slopes with bioengineering works in critical sites.

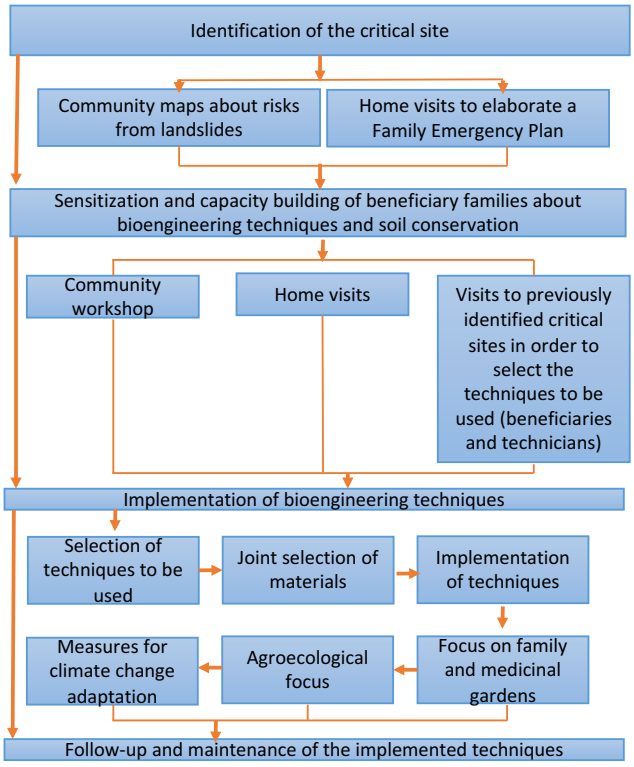


Figure: Carmen Paguada, Honduran/ Swiss Red Cross

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- all relevant actors, as part of a participatory approach
- ✓ mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- ✓ research findings
- ✓ personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- ✓ Research

Capacity building/ training

Training was provided to the following stakeholders
- ✓ land users
- field staff/ advisers

Form of training
- on-the-job
- ✓ farmer-to-farmer
- ✓ demonstration areas
- ✓ public meetings
- courses

Subjects covered
Bioengineering activities, soil conservation, climate change.

Advisory service

Advisory service was provided
- ✓ on land users' fields
- at permanent centres

Institution strengthening

Institutions have been strengthened/ established
- no
- yes, a little
- yes, moderately
- ✓ yes, greatly

at the following level
- ✓ local
- regional
- national

Describe institution, roles and responsibilities, members, etc.
Local Emergency Committees (CODELs) are part of the National System for Risk Management of Honduras. CODELs link communities with the national system through its higher level, the Municipal Emergency Committee. Candidates for CODEL must be accepted and approved by the community and included in the process to enhance local capacities for specific functions.

Type of support
- financial
- ✓ capacity building/ training
- ✓ equipment

Further details
Information on the structure, role and operation of CODEL in the community. CODEL members are trained to carry out all the steps involved in risk management (prevention, preparation, response and rehabilitation).

Research

Research treated the following topics
- sociology
- economics/ marketing
- ✓ ecology
- technology

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component
- < 2000
- 2000-10000
- ✓ 10000-100000
- 100000-1000000
- > 1000000

Precise annual budget: 38000

Major donor: This amount covers costs of material and support/transportation as well as training in bioengineering and home visits. It does not include the salaries of the technical team from Honduran/ Swiss Red Cross, since their area of work includes the full range of activities related to risk management. Local technicians are paid by Swiss Red Cross.

The following services or incentives have been provided to land users
- ✓ Financial/ material support provided to land users
- ✓ Subsidies for specific inputs
- Credit
- Other incentives or instruments

Financial/ material support provided to land users
Material Support (plants and tools) or transportation of material.

Subsidies for specific inputs (including labour)

Labour by land users was
- ✓ voluntary
- food-for-work
- paid in cash
- rewarded with other material support

equipment: tools

partly financed
fully financed
- ✓

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *Land users are very motivated and get involved on their own accord.*				✓
Did the Approach enable evidence-based decision-making? *Observing the demonstration sites convinced many people to implement the measures near their own homes.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *No bioengineering works to stabilise slopes were implemented before the project.*				✓
Did the Approach improve knowledge and capacities of land users to implement SLM?				✓
Did the Approach improve knowledge and capacities of other stakeholders? *Sensitisation workshops were provided to authorities and technicians in municipalities and the budget for DRR was increased in municipal development plans.*		✓		
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *The approach includes linking CODEL committees with municipalities and Municipal Emergency Committees (CODEM). Further, by providing support to land users, CODEL committees managed to increase their visibility and are acknowledged by other stakeholders.*				✓
Did the Approach mitigate conflicts? *In some cases, the approach had a positive effect on conflicts among neighbours caused by poor land management (damage to neighbour's property).*		✓		
Did the Approach improve gender equality and empower women and girls? *Maintenance is performed by women. They manage medicinal gardens and family orchards. Thus, they perform jobs previously done only by men, thus giving women new roles in their family. Also, they feel empowered by training and by receiving knowledge, and because they manage the medicinal gardens and family orchards.*				✓
Did the Approach encourage young people/ the next generation of land users to engage in SLM?			✓	
Did the Approach lead to improved food security/ improved nutrition? *The agroecological approach promotes the combination of bioengineering works with plants, fruit trees, vegetables and medicinal plants.*				✓
Did the Approach improve access to markets? *Though the approach does not aim at improving market access, it is significant to note that there is actually a small improvement in this regard. An indirect effect of bioengineering works is increase and diversification of production. Also, the surplus from family gardens is sold.*		✓		
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters?			✓	
Did the Approach lead to employment, income opportunities? *The families sell their surplus from family orchards.*		✓		

Main motivation of land users to implement SLM

- ✓ increased production
- increased profit(ability), improved cost-benefit-ratio
- reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- ✓ environmental consciousness
- customs and beliefs, morals
- ✓ enhanced SLM knowledge and skills
- ✓ aesthetic improvement
- conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: A cooperative process was used to implement bio-engineering works. This followed the principles of learning by doing and action-training. Land users felt prepared and motivated to maintain the implemented measures and some have been trained to implement new bioengineering techniques. The materials used are locally available and because they are vegetative, they regenerate easily.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Cooperative work has improved in the community. Bioengineering techniques are multipurpose: Bioengineering does not only reduce risks, but also recovers productive areas and economic opportunities, leads to improved SLM understanding and helps to diversify nutrition and improve health (by growing medicinal plants, reducing the growth of vectors).
- Cleaning the land and plots has tangible benefits: Not only are they aesthetically pleasing, but bioengineering techniques have a positive impact on human health as well as individual and community property. Also, they reduce damage.
- The safety of homes has been increased.

Key resource person's view

- These measures require little input and are easy to replicate with plant material found on the site, which grows easily.
- Bioengineering measures are adapted to local climate and extreme conditions.

Weaknesses/ disadvantages/ risks → *how to overcome*

Key resource person's view

- A waiting and watching period is needed to be able to see the protection provided by bioengineering.
- Without constant maintenance, bioengineering loses its capacity to provide protection and conservation. → *Constant maintenance.*

REFERENCES

Compiler: Helen Gambon - helen.gambon@redcross.ch
Resource persons: Carmen Paguada (claudio.stauffer@redcross.ch) - SLM specialist; Carlos Montes Lobo (claudio.stauffer@redcross.ch) - SLM specialist; José Isaias Guillén - land user; Lisandro Morales - land user; Ever Pastrana Medina - land user; Vicente Alonso Rivas - land user, Jorge Alberto Argueta
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_745
Linked SLM data: SLM Technology: Fascine drainage https://qcat.wocat.net/en/wocat/technologies/view/ technologies_744/; SLM Technology: V shaped catchment fence using Izote (Yucca sp.) https://qcat.wocat.net/en/wocat/technologies/view/ technologies_735/; SLM Technology: Living barriers https://qcat.wocat.net/en/wocat/technologies/view/technologies_735/
Documentation was facilitated by: Swiss Red Cross - Switzerland

Links to relevant information which is available online
Respuestas locales y desafíos globales: Reduccin de riesgos desde la comunidad. Sistematizacin de los proyectos desarrollados del 2005 al 2014 en seis municipios de los departamentos de Olancho, Valle y Choluteca, Honduras. Cruz Roja Suiza, 2016: info@redcross.ch (gratis)

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		☑			
Landslide		☑			
Convective storm	☑				
Tropical cyclone			☑		
Wildfire		☑			
Biological hazards					
Epidemics (humans)	☑				
Pest (vegetation)			☑		
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Approach was applied

Exposure								**Comment:**
of people	very high/ strong	☑					very low/ non-existent	
of private assets	very high/ strong	☑					very low/ non-existent	
of community infrastructure	very high/ strong		☑				very low/ non-existent	
Economic factors								
Access to markets	very high/ strong			☑			very low/ non-existent	
Income	very high/ strong			☑			very low/ non-existent	
Diversification of income	very high/ strong			☑			very low/ non-existent	
Savings/stocks	very high/ strong				☑		very low/ non-existent	
Bank savings/remittances	very high/ strong			☑			very low/ non-existent	*For some families remittances are the main source of income, however, not all families can count on remittances.*
Degree insurance coverage	very high/ strong					☑	very low/ non-existent	
Social factors								
Literacy rate	very high/ strong			☑			very low/ non-existent	
Government support	very high/ strong				☑		very low/ non-existent	
Family support	very high/ strong	☑					very low/ non-existent	
Community support	very high/ strong		☑				very low/ non-existent	
Access to public services	very high/ strong			☑			very low/ non-existent	
Physical factors								
Robustness of houses	very high/ strong			☑			very low/ non-existent	*Most homes are out of adobe.*
Robustness of infrastructure	very high/ strong		☑				very low/ non-existent	*Majority of the infrastructure is brick.*

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☑ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☐ 0
☐ 1	☐ 1
☐ 2-5	☑ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☑ 11-50	☐ 11-50
☐ 51-100	☑ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☐ > 500	☐ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☑ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☐ 1-20%
☐ 21-50%	☑ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☑ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10'000 USD	☐ 5001-10'000 USD
☐ 10'001-50'000 USD	☐ 10'001-50'000 USD
☐ 50'000-250'000 USD	☑ 50'000-250'000 USD
☐ > 250'000 USD	☐ > 250'000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☑ > 10 years

Protection goal of SLM Approach

Mitigate the impact of landslides, debris flows and surface water runoff on housing and community infrastructure. Designed for frequent and medium-intensity events, they can mitigate high-intensity events, even if established

IMPACTS

Additional benefits of the Approach

Safety (on-site)			**Comment:**
Safety of people	decreased	increased	
Safety of esp. vulnerable	decreased	increased	
Safety of key documents	decreased	increased	
Economic goods (on-site)			
Safety of individual housing	decreased	increased	
Safety of water stocks	decreased	increased	
Safety of land assets	decreased	increased	
Safety of communal assets	decreased	increased	
Other impacts (on-site)			
Health	decreased	increased	*The reduction of puddles has been achieved a reduction of vectorial diseases.*
Nutrition	decreased	increased	*Home gardens have contributed to a diversified and balanced diet.*

Off-site impacts

None



Excavation of soil and water conservation channels with earth ties (Kenneth Twinamasiko).

Soil and water conservation channels (Uganda)

Emirongooti

DESCRIPTION

A soil and water conservation channel or 'infiltration ditch' is an excavated trench along the contour, with earth ties within the channel at regular intervals, that traps water and soil washed downslope during a downpour.

The technology is applied in already existing degraded farmlands, which are individually owned. An average farm size is less than half an acre (less than 0.2 ha). A typical soil and water conservation channel is a trench 1m wide, 1m deep and with earth ties within the trench which prevent lateral flow of water along the trench. The channels are set at horizontal intervals of 10m (i.e. 10 m apart) and aligned along the contour. The excavated soil is piled up to form an earth bund next to the trench on the lower side and stabilised by planting hedgerows of "Starria grass" to avoid erosion. This technology reduces the speed of water running down the slope during a downpour and traps the water and soil that is being washed thereby reducing soil erosion and increasing water retention. Areas which are prone to degradation by erosion are identified and later, the farmers are trained regarding the benefits of this technology, how to lay out the channels by use of the "A –frame", how to construct the channels and how to maintain them by periodic de-silting and planting grasses and shrubs on the bunds. The "A - Frame" is an A shaped structure made from wooden poles or thin metal poles that can be easily constructed and used to peg out level or graded contours or water drains. This technology helps maintain fertile top soil, which would have otherwise been washed down the slope into the valley and into streams. It also increases water retention. The land users like the technology because their soil is not lost, but what they dislike is that it is labour intensive and takes part of the land out of production. Laying channels out is technical and not easily conceptualised, though quite simple when learned. Individual land users excavate these channels on their own plots of land using simple hand tools like hoes, spades and pick axes.

LOCATION



Location: Rubaya Sub County, Kabale District, South Western Region, Uganda

No. of Technology sites analysed: 100-1000 sites

Geo-reference of selected sites
- 29.9397, -1.4164
- 29.9394, -1.4152
- 29.9396, -1.4157
- 29.9486, -1.4034

Spread of the Technology: evenly spread over an area

Date of implementation: 2015

Type of introduction
- ☐ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ☐ during experiments/ research
- ☑ through projects/ external interventions



Excavation of soil and water conservation channels separated by earth ties (Kenneth Twinamasiko).



Use of the 'A-frame' to lay out the soil and water conservation channels (Kenneth Twinamasiko).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Cropland - Annual cropping, Perennial (non-woody) cropping
Main crops (cash and food crops): Potatoes, beans, maize, sorghum, cabbages, tobacco, peas, wheat, barley



Mixed (crops/ grazing/ trees), incl. agroforestry
Main products/ services: Trees, poles, fodder, firewood

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Livestock density: n.a.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying, Wm: mass movements/ landslides

SLM group

- cross-slope barriers
- rotational systems (crop rotation, fallows, shifting cultivation)
- improved ground/ vegetation cover
- integrated soil fertility management

SLM measures



vegetative measures - V1: Tree and shrub cover, V2: Grasses and perennial herbaceous plants



structural measures - S3: Graded ditches, channels, waterways

TECHNICAL DRAWING

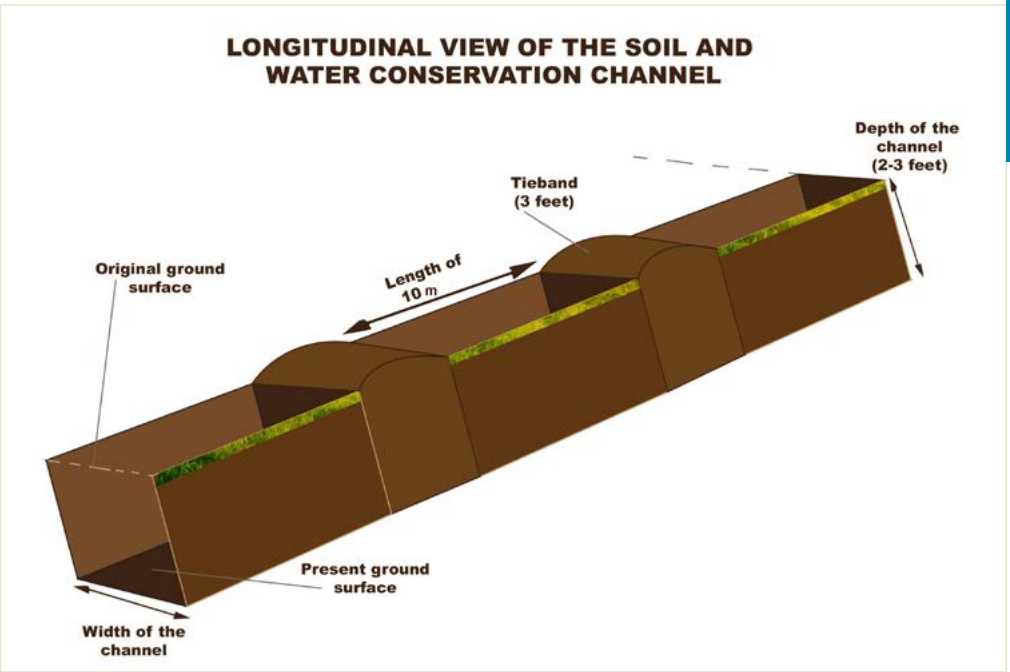


Figure: Kigezi Diocese Water and Sanitation Programme

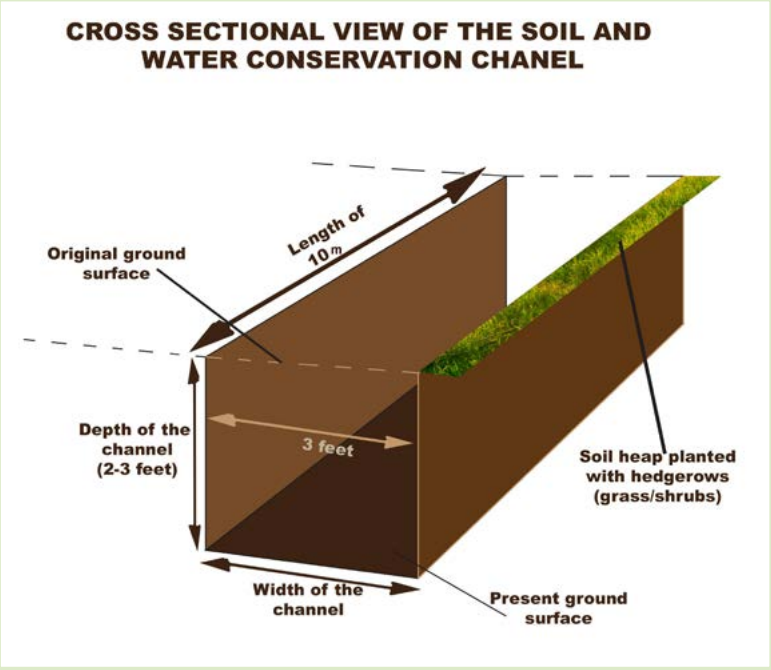


Figure: Kigezi Diocese Water and Sanitation Programme.

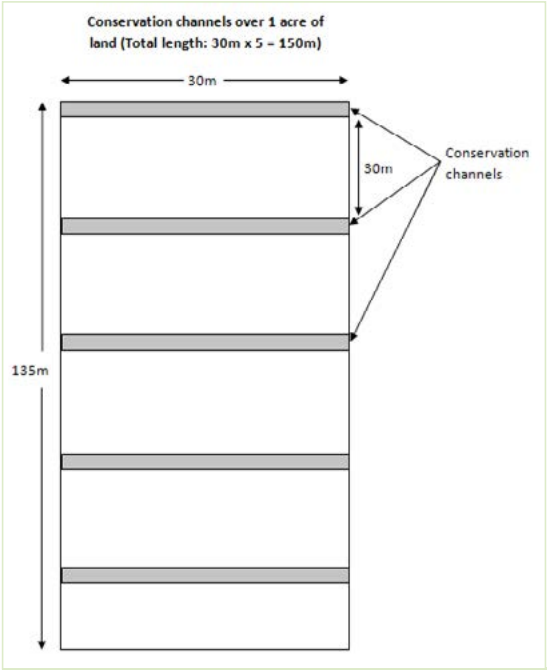


Figure: Kigezi Diocese Water and Sanitation Programme.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Per acre (each acre usually has 150 metres of channels)**)
- Currency used for cost calculation: **US Dollars**
- Average wage cost of hired labour per day: USD 2.12.

Most important factors affecting the costs

The costs have been calculated basing on depth of soil of 50 – 80 cm. When the depth of the soil is shallow, then the costs of breaking the underlying sub-surface layers, which are usually rock, are much higher. Also during the rainy season, the soil is more workable. The costs of maintenance will be less where the rest of the landscape also has conservation channels, has good vegetative cover and where the slope is gentle - because there will be less sediment washed downslope into the channels.

Establishment activities

1. Laying out the soil and water conservation channel using the A-frame to establish the contour lines (Structural; After harvest of crops).
2. Excavation of the soil and water conservation channel and build up soil bund on the lower side of the trench; leave a tie every 10 metres (Structural).
3. Planting of hedge rows on the bunds (Vegetative).

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Setting out	metre	150.0	0.02	3	100
Excavation of the channels	metre	150.0	1.06	159	100
Planting starria grass	metre	150.0	0.02	3	100
Equipment					
Forked hoes (1 piece can excavate 1km)	metre	6.67	5	33.35	
Pick axes (1 piece can excavate 1km)	metre	6.67	5	33.35	
Spades (1 piece can be used on 1km)	metre	6.67	5	33.35	
Plant material					
Starria grass (1 sack for 20m)	sacks	7.5	7	52.5	0
Total costs for establishment of the Technology				**317.55 USD**	

Comment: The land users, after being trained, lay out the soil and water conservation channels for themselves but the tools are beyond the financial capacity of the land user hence there is need for a subsidy.

Maintenance activities

1. De-silting the channels and spreading the silt on the fields and restoring the bands (Structural; When half full).
2. Maintenance of the hedge rows by trimming and gapping up empty spaces (Vegetative).

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Desilting of channels (when half full)	metre	1.0	0.265	0.27	100
Trimming of hedge rows (100m per day)	metre	1.0	0.0212	0.02	100
Total costs for maintenance of the Technology				**0.29 USD**	

Comment: The initial investment of the equipment is adequate for maintenance at least for some years.

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [x] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone

- [ ] humid
- [x] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate

Bi-modal rainfall pattern with long rainy season from September to December then March to May.
Name of the meteorological station: Kabale District Metreological Department.

Slope

- [ ] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [x] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform

- [ ] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude

- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [x] 1501-2000 m a.s.l.
- [x] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth

- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content

- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water
- [ ] excess
- [x] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [x] yes
- [ ] no

Comment: Water quantity and quality is dependent on human activities and rainfall patterns.

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓				good
education	poor	✓				good
technical assistance	poor		✓			good
employment (e.g. off-farm)	poor	✓				good
markets	poor		✓			good
energy	poor	✓				good
roads and transport	poor	✓				good
drinking water and sanitation	poor	✓				good
financial services	poor	✓				good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

crop production	decreased						✓	increased
crop quality	decreased						✓	increased
fodder production	decreased						✓	increased
fodder quality	decreased						✓	increased
risk of production failure	increased						✓	decreased
production area (new land under cultivation/ use)	decreased						✓	increased
land management	hindered							✓ simplified

Comment: The impacts are seen immediately after the first crop.

expenses on agricultural inputs	increased		decreased
farm income	decreased		increased
diversity of income sources	decreased		increased
workload	increased		decreased

Socio-cultural impacts

food security/ self-sufficiency	reduced		improved
health situation	worsened		improved
community institutions	weakened		strengthened
SLM/ land degradation knowledge	reduced		improved
conflict mitigation	worsened		improved

Ecological impacts

surface runoff	increased		decreased
groundwater table/ aquifer	lowered		recharged
soil moisture	decreased		increased
soil cover	reduced		improved
soil loss	increased		decreased
soil accumulation	decreased		increased
soil organic matter/ below ground C	decreased		increased
flood impacts	increased		decreased

Off-site impacts

water availability (groundwater, springs)	decreased		increased
downstream flooding (undesired)	increased		reduced
damage on neighbours' fields	increased		reduced
damage on public/ private infrastructure	increased		reduced

Benefits compared with establishment costs

Short-term returns	very negative		very positive
Long-term returns	very negative		very positive

Benefits compared with maintenance costs

Short-term returns	very negative		very positive
Long-term returns	very negative		very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

annual temperature increase	not well at all		very well	
seasonal temperature increase	not well at all		very well	Season: wet/ rainy season
seasonal temperature increase	not well at all		very well	Season: dry season
annual rainfall decrease	not well at all		very well	
seasonal rainfall decrease	not well at all		very well	Season: wet/ rainy season

Climate-related extremes (disasters)

local rainstorm	not well at all		very well
local thunderstorm	not well at all		very well
local hailstorm	not well at all		very well
land fire	not well at all		very well
general (river) flood	not well at all		very well
flash flood	not well at all		very well
landslide	not well at all		very well
epidemic diseases	not well at all		very well
insect/ worm infestation	not well at all		very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☑ 1-10%
- ☐ 10-50%
- ☐ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ☑ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ☐ 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- ☐ Yes
- ☑ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view
- It controls soil loss from the land users' fields.
- It provides silt which is spread on their fields.
- Hedgerows are used as fodder and as mulching material.
- The conserved water is used to benefit the plants in the same field.

Key resource person's view
- It improves water infiltration in the soil which increases soil moisture content and increases ground water recharge.
- It is a simple technology which uses common hand tools.
- It reduces conflicts related to earth being washed into the neighbours' plot since land is fragmented.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view
- This technology requires a lot of hard labour. → *The land users were encouraged to form small groups which work together to ease the work and share knowledge and skill.*
- Land users feel that the channels take up a lot of their land, which would otherwise be used for growing crops. → *The land users have been helped to appreciate the benefits of the technology in making the seemingly smaller land more productive.*

Key resource person's view
- This technology is dependent on land users continued efforts in de-silting and maintenance of the hedgerows. When this is not done the technology fails. → *Land users are encouraged to periodically desilt the channels.*
- The effectiveness of this technology is dependent on the compliance of other land users in the landscape. For example if it is done downhill and not uphill, then the channels will be overwhelmed by the volume of the soil and water runoff. → *All community members were sensitised on the importance and effectiveness of this technology and existing by-laws will foster members farming upslope to practice the technology. The benefits of the technology will encourage other land users to adopt it.*
- The process of maintaining and rolling out this technology requires engagement of many stakeholders. → *Management structures, which are well linked with government structures, have been set up and trained at various levels to manage the process of maintaining and rolling out the technology.*

REFERENCES

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Linked SLM data: SLM Approach: Catchment Based Integrated Water Resources Management Https://qcat.wocat:net/en/wocat/approaches/view/approaches_724
Documentation was facilitated by: Tear Fund Switzerland - Switzerland

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Kigezi Diocese Water and Sanitation Programme, IWRM Annual Report (April 2015 - March 2016): www.kigezi-watsan.ug
IWRM Pilot report 2013: www.kigezi-watsan.ug

Links to relevant information which is available online
Handbook of chennel design for soil and water conservation: www.worldwidehelpers.org
Soil conservation handbook: www.wcc.nrcs.usda.gov/ftpref/wntsc/H&H/TRsTPs/TP61.pdf
Soil conservation: http://www.fao.org/docrep/t0321e/t0321e-10.htm



A typical FMNR site in West Kenya. The acacia trees have established naturally. The farmer simply allows the trees to grow and carries out pruning as required. The zone below the trees can be used to grow crops or fodder grass: it also provides bees with flowering vegetation. The photo was taken two years after introducing FMNR to 1000 smallholder farmers in Homa Bay County (Thomas Kalytta).

Farmer Managed Natural Regeneration (FMNR) (Kenya)

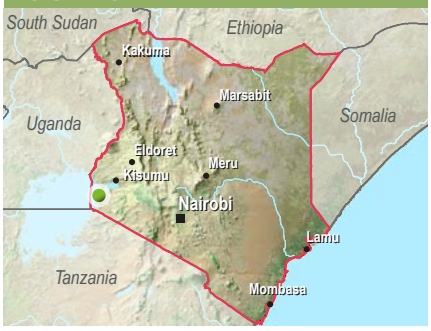
FMNR

DESCRIPTION

Farmer Managed Natural Regeneration (FMNR) is a proven SLM Technology to restore degraded wasteland and improve depleted farmland. The farmer regulates and facilitates the re-growth of existing trees stumps, or self-sown seeds in the soil, and thus promotes soil fertility and through better ground cover, increases protection from runoff and erosion.

Conventional afforestation and tree planting requires considerable inputs, labour and care including suitable seedlings, transport of these, planting and regular watering - and the survival rate in arid and semi-arid climates is often very poor. On the other hand Farmer Managed Natural Regeneration (FMNR) is a cheap and effective way to restore and improve large areas of degraded and depleted soils. The technology relies on the fact that even in deforested areas, soils often maintain some active roots systems and viable seeds of native woody plants. Selectively promoted, leaving only a few main shoots, they can grow into trees within a few years. This technology - based on indigenous practices - has been successfully promoted by World Vision in eight African countries including Kenya and Ethiopia, and is now also being applied in Indonesia, East Timor and Latin America. Apart from labour and a farmer's knife and skills, there are no major inputs required. Farmers like this from of agroforestry technology as it is cheap and can be easily combined with other SLM technologies such as permaculture, intercropping, and mulching. At the same time it can be used at various scales: on small plots of less than one hectare or up to the landscape level where whole hills can be re-vegetated within a short period. And the impact can be very positive on the soil, ecology, climate and health of crops, people and livestock. The farmer can use prunings as firewood, and grow fodder below the trees; tree branches and leaves can serve for mulching and the flowers for bees, and fruits for consumption and sale. The trees break the winds, protect the soil and (with some species) their shade protects sensitive crops (e.g. vegetables or even coffee) from the sun. The soil's water retention capacity, structure, biology and fertility improve. All effects contribute to soil, water and climate stabilisation. One limitation can be the use of tractors and other machines which, however, are hardly employed by smallholder farmers. Some practical steps for establishing an FNMR site; 1) jointly agree on a target area (be it a field or communal wasteland) 2) check out the area carefully for existence of woody species (trees, bushes, rootstocks) 3) mark the bushes or trees that should be nurtured into bigger trees (it is recommended to consult local/ scientific knowledge on the trees species and their positive benefits) 4) protect the whole area (fences, hedges) or only the chosen trees against grazing and human disturbance 5) when the plants reach a height of 1 m start with pruning, only keeping the 2-3 main shoots, using the prunings for firewood or mulching 6) watering is in most cases not required as the indigenous trees have well-enough developed roots 7) the specific cultivation and management practice depends on the trees species selected and the desired results (intercropping with maize, shade trees for coffee, fodder trees for livestock, flower trees for bees etc.) 8) fire and livestock are the main threats to a new FMNR site.

LOCATION



Location: Suba and Mbita Sub-Counties, Homa Bay Country, Kenya

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites
- 34.215, -0.55

Spread of the Technology: evenly spread over an area of approx. 1-10 km²

Date of implementation: 2014; less than 10 years ago (recently)

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

World Vision SWITZERLAND



FMNR starts by identifying and selecting the most suitable trees that are already onsite. Though the plant might be very small, this might disguise a root system that can enable a kick start in growth as soon as the plant receives protection from livestock. Photo taken during a practical FMNR training (Thomas Kalytta).



Obanda FMNR site, two years after starting to apply the technology. More indigenous tree species have appeared as well as the dominant acacias. Fodder grass has already grown high and is ready for harvest. Passion fruit, leucaena and other agroforestry trees are interspersed (Irene Ojuok).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- ✓ preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- ✓ create beneficial economic impact
- create beneficial social impact

Comment: This technology brings a lot of positive effects to the environment (more water, more carbon and nutrients in the soil, better micro-climate etc.) It contributes to reduce risk of disasters. Other technologies reducing disaster risk could include mixed farming, water harvesting etc.

Number of growing seasons per year: 1

Land use before implementation of the Technology:

Livestock density: Livestock are one of the main threats to the technology. It is very important to keep livestock out of the FMNR areas either by using live fences (hedges) or mesh fences.

Land use



Mixed (crops/ grazing/ trees), under an agroforestry system.

Main products/ services: The native trees provide shade, organic matter, fruits, fodder, firewood, bee pastures etc. Typical crops in Kenya grown below the FMNR trees are maize, millet, mung beans, amaranthus, sorghum, vegetables and coffee. It can be an advantage to promote the growth of leguminous trees as they serve as a source of nitrogen and many of them produce pods eaten by livestock.



Unproductive land - degraded wasteland

Remarks: Many of the typical hills and areas in Suba Sub-County are degraded and without forest. Over-exploitation through grazing and charcoal burning have led to deforestation and soil degradation. Most of the streams have disappeared. The climate has become more harsh and arid. The native trees grown through FMNR and their associated agroforestry systems provide multiple benefits as already indicated.

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- ✓ restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Comment: FMNR contributes to less land degradation and is an ideal technology to restore severely degraded areas.

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying



soil erosion by wind - Et: loss of top



biological degradation - Bc: reduction of vegetation cover, Bq: quantity/ biomass decline, Bs: quality and species composition/ diversity decline

Comment: FMNR contributes to less soil erosion, more organic matter and more diversified habitats (leading to increased agro-biodiversity).

SLM group
- natural and semi-natural forest management
- agroforestry
- improved ground/ vegetation cover

SLM measures



vegetative measures - V1: Tree and shrub cover

TECHNICAL DRAWING

Technical specifications

The technical drawing shows four typical stages of an indigenous tree in a FMNR site:

1) a suppressed shrub, very damaged by livestock or human interference.
2) if this small shrub is protected it will regenerate and grow new branches quickly.
3) as soon as a bush has reached a height of 1 m the farmer can start with pruning - keeping only a few major branches. This will help the tree to grow tall and the farmer can use pruned branches and leaves for firewood and mulching. Depending on the growth rate, pruning can be done 1-2 times a year.
4) Some trees produce fruits that can be harvested. As only major branches are left, enough sunlight will reach the ground to allow the cultivation of crops or grass production.
5) Slope and spacing can vary a lot (from 5 to 5 m distance between trees) as FMNR is designed to be an extremely flexible system, giving farmers considerable freedom to meet their own specific needs, using the species mix to respond to soils, crops, and their own understanding, at the time of implementation. FMNR is being introduced into many different contexts where the environment and species mix, the specific land use (crop land, pasture or forest) and farmer needs, vary from region to region and from farm to farm.

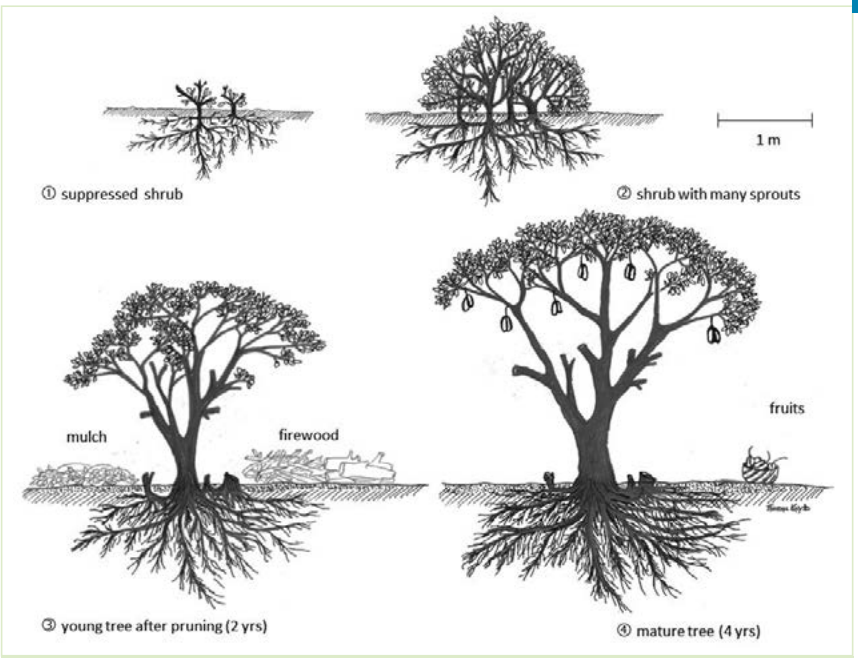


Figure: Thomas Kalytta

To date, FMNR has been successfully practiced in a variety of locally adapted ways such as:

- By individual farmers on their own land
- By communities on communal lands and in degraded forests
- By leaving few trees (10 - 20 / ha), or by leaving many (above 150 trees/ ha).
- By focusing on tree species predominantly used to provide firewood and building poles, or on species that have nutritious leaves that feed families or animals. Some prefer leguminous trees that fix nitrogen and can therefore increase the soil fertility for crops.
- Leaving a single stem to grow from a stump (and harvesting when larger), or by leaving multiple stems, successively harvesting one each year.
- Allowing a single stem to grow into a large tree, and then harvesting 1/2 to 1/3rd of the branches per year (i.e. pollarding). Pollarding provides larger wood harvests and more rapid re-growth.
- Allowing tree re-growth only on farm borders. The trees are allowed to grow close to each other and are pruned high up the trunk. As need arises whole trees are harvested and re-growth is allowed to replace the tree.
- Leaving only trees, which are growing approximately in straight lines and moving self-sown seedlings and replanting them within these lines. Within the rows the trees are grown as bushes which are slashed to ground level during the rainy season, except for single stems that are allowed to grow about every 12 metres. This is done to avoid interference with ploughing and because soil infertility is a major issue, addressed by mulching with pruned branches.

Comment: One idea is to grow FMNR trees only in lines: this allows better ploughing or even mechanisation. The spacing between the lines should be 12 m or more depending on the tree species and type of mechanisation.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: 1; conversion factor to one hectare: **100 trees/ ha**)
- Currency used for cost calculation: **Kenyan Shilling (KES)**
- Exchange rate (to USD): 1 USD = 100 KES.
- Average wage cost of hired labour per day: 400 Kenyan Shillings.

Most important factors affecting the costs

Size of the FMNR site and the density and age of trees. One important precondition is fencing off the sites/ protection of trees against livestock. Most of the equipment needed is part of the normal agricultural tool set.

Establishment activities

1. Plot inspection (to identify and mark potential bushes) (Vegetative; ideally after harvesting the crops, best time for transects)
2. Plot protection (fencing against livestock) (Structural)
3. Alternatively: protection measures of single bushes (Structural)
4. Weeding/ clearance of surplus bushes/ vegetation (Agronomic)
5. Normal farming activities within the FMNR site (Agronomic)
6. Integrating beekeeping and or fodder harvesting (Agronomic)
7. Thinning or harvesting of fuel wood (Management)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
plot protection - fencing/ ha	person days	30.0	400	12000	100
tree protection - first pruning/ ha	person days	10.0	400	4000	100
Equipment					
farmer's knife	pieces	2.0	150	300	100
machete	pieces	2.0	500	1000	100
rake	pieces	2.0	500	1000	100
hand hoe	pieces	2.0	450	900	100
leather gloves	pieces	2.0	1000	2000	100
strong gumboots	pair	2.0	2000	4000	100
axe	pieces	2.0	700	1400	100
Plant material					
live fence seeds/ thorns of shrubs / ha	seedlings	1200.0	5	6000	100
Total costs for establishment of the Technology				**32600 KES**	

Maintenance activities

1. Pruning of target bushes and trees (Vegetative; ideally in the dry season)
2. Tree felling (Vegetative)
3. Harvesting of grass in FMNR sites - those not used for crops (Vegetative)

Ideally, FMNR activities do not interfere too much with normal farming activities except for mulching or compost making for which small tree branches can be used.

In places where FMNR is applied to provide timber, branches and firewood in a sustainable way, it has supported income for households helping them to meet their basic needs including school fees, medical bills etc.

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Yearly pruning of target bushes and trees/ ha	person days	6.0	400	2400	100
tree felling of selected trees/ ha	person days	4.0	400	1600	100
Equipment					
farmer's knife	pieces	2.0	150	300	100
machete	pieces	2.0	500	1000	100
rake	pieces	2.0	500	1000	100
hand hoe	pieces	2.0	450	900	100
Total costs for maintenance of the Technology				**7200 KES**	

Comment: The farmer harvests wood and non-wood products like honey and grass. Often FMNR is combined with agriculture or animal husbandry. As the crop yield increases the farmer can invest in more equipment and tools. Some of the costs incurred were covered by WV during inception of the project model of FMNR especially for the demonstration plots but the costs at household level are covered by the farmers themselves. Normal farm equipment is used to establish the sites. The farmer needs gloves, gumboots and time for the additional works. Also, some time is needed to be invested in training to become equipped with the knowledge required and skills. Live fence plants or thorns from shrubs are normally collected/ taken from the pruned acacia branches.

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1000 mm
- ☑ 1001-1500 mm
- ☐ 1501-2000 mm
- ☐ 2001-3000 mm
- ☐ 3001-4000 mm
- ☐ > 4000 mm

Agro-climatic zone

- ☐ humid
- ☐ sub-humid
- ☑ semi-arid
- ☐ arid

Specifications on climate

Average annual rainfall in mm: 1350

The precipitation varies a lot within the area/ county.

Daily maximum temperatures range between 26°C during the coldest months (April and November) and 34°C during the hottest months (January to March).

Name of the meteorological station: Homa Bay, Homabay Airport, NY, Kenya (lat -0.6000°, long 34.4670°, altitude 1305 metres)

Rainfall is distributed over two rainy seasons: April-May (long rains) and September to November (short rains).

Slope
- [ ] flat (0-2%)
- [x] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [x] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [ ] plateau/ plains
- [ ] ridges
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Altitude
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- [ ] very shallow (0-20 cm)
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Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
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Topsoil organic matter content
- [ ] high (>3%)
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Groundwater table
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- [ ] < 5 m
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Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [x] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [x] yes
- [ ] no

Occurrence of flooding
- [x] yes
- [ ] no

Comment on water quality and quantity: The quality of surface water is poor and sometimes only suitable for livestock. Though due to few safe water sources, the households often have to use surface runoff for domestic use.

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

Comment: Biodiversity is still higher than expected in comparison to the degree of degradation of the landscape. This might relate to the proximity of the Lake Victoria with its rich fish-and avifauna and Ruma National Park.

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
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- [x] manual work
- [x] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [ ] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [x] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village group
- [ ] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [x] individual

Comment: All the above groups participate in the roll-out of the technology. It is relatively new and many are excited about the benefits. Elderly and children (youth and child headed households) need more time to do the same work and adopt the technology less enthusiastically. Though the elderly are often key drivers of the technology as they best understand the degree of deforestation and water insecurity and the inter-linkages.

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good
child protection	poor ✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production	decreased	increased ✓	**Before SLM:** 5 bags of maize/ acre **After SLM**: up to 8 bags of maize/ acre
fodder production	decreased	increased ✓	**Before SLM:** Less than 10 bags (90kg) of harvested grass/ acre **After SLM:** More than 20 bags (90kg) harvested grass/ acre **Comment:** This applies to 1 acres piece of land that was not managed on FMNR compared to same size on good management FMNR and better quality fodder.
wood production	decreased	increased ✓	**Comment:** More wood is obtained from FMNR site because biomass increases faster and new ones regenerate faster. Before SLM, tree growth was suppressed.
non-wood forest production	decreased	increased ✓	**Before SLM:** 0 beehive **After SLM:** 10 hives/ acre **Comment:** Beehives for honey production could be introduced as more vegetation and flowers are now available. Medicinal plants are also gaining in importance.
land management	hindered	simplified ✓	**Before SLM:** Poor **After SLM:** Better **Comment:** It was not easy to manage the land before FMNR application. After the SLM technology was adopted the farmers find it less hard to work their farms - besides the land value also went up.
irrigation water availability	decreased	increased ✓	**Comment:** Since FMNR improves the soil cover, less erosion and siltation take place in the community dams; hence more water becomes available. Equally, those who harness surface runoff are able to get water for micro irrigation within their homesteads.
farm income	decreased	increased ✓	**Before SLM:** Low **After SLM:** Medium **Comment:** FMNR has provided additional/ alternative sources of income to the beneficiaries. Sales from wood, honey, medicinal components and non-wood products etc. This has led to a diversification of income sources.
workload	decreased ✓	increased	**Comment:** The workload has increased slightly, depending on the density of FMNR trees on farm. The work is, however, more diverse.

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved ✓	**Comment:** The more diversified livelihoods reduce the risk of food insecurity. The impact of disasters will reduced and self-sufficiency will increase.
recreational opportunities	reduced	improved ✓	**Comment:** Some of the farmers established recreational sites as the microclimate has improved and the beauty of the sites also; more animals can be seen including birds and butterflies but at the same time dangerous snakes appear. Some sacred sites have also been safeguarded, as old trees are traditional places for worship.
SLM/ land degradation knowledge	reduced	improved ✓	**Comment:** Areas with deep gullies before FMNR application have been restored. This is clear evidence that the technology has high potential to rehabilitate degraded ecosystems.

Ecological impacts

soil moisture	decreased	increased	**Comment:** Notable improvement. It has been proved that growing conditions and availability of water for crops under suitable trees can be much better if the tree density is not too high.
soil cover	reduced	improved	**Comment:** The additional vegetation provides protection of the soil against water and wind erosion.
soil organic matter/ below ground C	decreased	increased	**Comment:** Higher organic matter can be found on FMNR sites.
vegetation cover	decreased	increased	**Comment:** A biodiversity study shows already after 3 sampling periods that more species are found on FMNR/ restored sites (by Maseno University in Kisumu).
plant diversity	decreased	increased	**Comment:** Increase in population and density of indigenous tree species that can be part of the agroforestry system.
animal diversity	decreased	increased	**Comment:** Many animal species find safe habitats in new FMNR sites.
beneficial species (predators, earthworms, pollinators)	decreased	increased	**Comment:** Birds, butterflies, wild bees, spiders etc. – they control pests and pollinate the crops.
habitat diversity	decreased	increased	**Comment:** Compared to degraded sites FMNR sites provide more habitats e.g. in the trees or soil.
pest/ disease control	decreased	increased	**Comment:** Still not yet proven - but the expectation is that pests will be less harmful as the coping mechanism of the agro-ecological system is better due to more predators (spiders, birds, frogs etc.)
flood impacts	increased	decreased	**Comment:** FMNR serves also to mitigate the impact of annual floods to the crops and settlements.
drought impacts	increased	decreased	**Comment:** FMNR improves the micro-climate and soil moisture. The technology therefore mitigates the impact of droughts.
emission of carbon and greenhouse gases	increased	decreased	**Comment:** Increase of tree cover through afforestation or FMNR as one of the ways to sequester carbon in biomass.
fire risk	increased	decreased	**Comment:** Tree cover can increase the risk of major wild fires. Firebreaks should be considered for larger FMNR sites.
wind velocity	increased	decreased	**Comment:** The trees established under FMNR serve as wind-break and protect houses, greenhouses, and crop fields against heavy winds.
micro-climate	worsened	improved	**Comment:** Micro-climate and humidity improves due to more vegetation and evaporation.

Off-site impacts

water availability (groundwater, springs)	decreased	increased	**Comment:** Increase in water retention which increases the ground water levels.
downstream siltation	increased	decreased	**Comment:** Due to less wind and water erosion siltation of ponds and water pans is reduced.
buffering/ filtering capacity (by soil, vegetation, wetlands)	reduced	improved	**Comment:** Vegetation cover allows for good filtration and reduces the immediate surface water runoff which can lead to flooding.
impact of greenhouse gases	increased	reduced	**Comment:** The additional tree cover acts as carbon sink and mitigation measure against global warming.

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

micro- climate increase — not well at all ☐☐☐☐☑ very well — Season: dry season

Climate-related extremes (disasters)

drought	not well at all ☐☐☐☑☑	very well
forest fire	not well at all ☐☑☐☐☐	very well
land fire	not well at all ☐☑☐☐☐	very well
flash food	not well at all ☐☐☐☑☐	very well
insect/ worm infestation	not well at all ☐☐☐☐☑	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☐ 1-10%
- ☐ 10-50%
- ☑ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ☐ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ☑ 90-100%

Number of households and/ or area covered

Over 1000 households have been reached through training and are confirmed as practising the Technology.

Has the Technology been modified recently to adapt to changing conditions?

- ☐ Yes
- ☑ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- FMNR is appropriate for both men and women though at the beginning depending on nature and size of the farm, men are more advantaged due to its labour intensiveness. However, for land with no trees yet established it can be easily managed by both sexes. It is also a form of exercise thus improving lifestyles.
- Men's work is more related to trees, clearing of land, construction and using of land machines including ploughing, but women play an important role in the rest of the field work.

Key resource person's view

- FMNR can be carried out by anyone/ everyone in a household as long as the drive and understanding of the concept is embraced. It is cheap, efficient and refreshing plus satisfying since results are evident rapidly. Tree planting survival rate has been low in the recent times following unreliable rainfall, external threats e.g livestock, pests and diseases thus FMNR is one solution in restoring degraded ecosystems. Women may find management difficult at some stage but since the concept brings income, external labour can be profitably sourced. Women don't fear getting on with the technology.
- FMNR is a low cost technology and brings good return on investment but since the practice bring higher income external labour can be hired. Farmers are very optimistic of the long-term results of FMNR science since the need for wood is high. Local people have started looking at having trees on farm as an investment.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Safety of the farmers during management (thick thorny bushes) and the habitat it creates for wildlife that could be threats to man e.g snakes; monkeys eating crops as birds feed on the seeds too. → *Monkeys can be kept out by thorny hedges, birds by mirrors and cats.*
- Slightly more land is required and mechanisation can become more difficult. → *Mechanisation can be done if new trees are aligned along rows or the boundary plots allowing enough space for mechanised cultivation in-between.*

Key resource person's view

- Women may find management difficult at some stage and quite labour intensive. → *Since the technology brings income even external labor can be sourced.*

REFERENCES

Compiler: Thomas Kalytta - t.kalytta@worldvision.ch
Resource persons: Irene Ojuok (Irene_Ojuok@wvi.org) - SLM specialist; Thomas Kalytta (thomas_kalytta@wvi.org); William Sijenyi Onyiego (N/A) - land user
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/ technologies_507/
Video: https://player.vimeo.com/video/55277450
Linked SLM data: WOCAT SLM Technology: FMNR implementation approach; https://qcat.wocat.net/en/wocat/approaches/view/approaches_733
Documentation was facilitated by: World Vision - Switzerland

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Renew The Land - FMNR in Timor-Leste: https://www.youtube.com/watch?v=ub2K8QGy8k0
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Proven successes in agricultural development: Increasing the Number of On-Farm Trees in Niger: http://www.ifpri.org/publication/millions-fed Afrikas Waldmacher (ZDF heute-journal vom 2.9.2016) German video: https://www.youtube.com/watch?v=tgdcbxE-OQo
FMNR regreening projects in East Africa: https://www.youtube.com/watch?v=ElfgcWCmops; http://fmnrhub.com.au/projects

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Mass movement			✓		
Flood		✓			
Landslide			✓		
Extreme Temperature		✓			
Fog		✓			
Dust clouds		✓			
Drought		✓			
Wildfire		✓			
Biological hazards					
Epidemics (Humans)			✓		
Epizootics (animals)			✓		
Pest (vegetation)			✓		
Insect infestation		✓			
Animal / rodents incidents			✓		
Invasive plants		✓			
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

							Comment:
Exposure							
of people	very high/ strong			✓		very low/ non-existent	*Sites can differ a lot from each other, so we think about a typical site here.*
of private assets	very high/ strong			✓		very low/ non-existent	
of community land	very high/ strong		✓			very low/ non-existent	*Land is deforested and prone to erosion due to low forest cover less than 1%.*
of community infrastructure	very high/ strong			✓		very low/ non-existent	
Economic factors							
Access to markets	very high/ strong				✓	very low/ non-existent	*Over 50% of the population are subsistence farmers characterised by poor harvest and therefore with limited income as they have not much surplus to sell on the markets.*
Income	very high/ strong				✓	very low/ non-existent	
Diversification of income	very high/ strong				✓	very low/ non-existent	
Savings/stocks	very high/ strong				✓	very low/ non-existent	
Bank savings/remittances	very high/ strong					✓ very low/ non-existent	
Degree insurance coverage	very high/ strong					✓ very low/ non-existent	
Social factors							
Literacy rate	very high/ strong				✓	very low/ non-existent	
Government support	very high/ strong				✓	very low/ non-existent	
Family support	very high/ strong		✓			very low/ non-existent	
Community support	very high/ strong			✓		very low/ non-existent	
Access to public services	very high/ strong				✓	very low/ non-existent	
Physical factors							
Robustness of houses	very high/ strong				✓	very low/ non-existent	*Most houses are made from mud and some few bricks.*
Robustness of infrastructure	very high/ strong				✓	very low/ non-existent	
Robustness of water sources	very high/ strong					✓ very low/ non-existent	

Other vulnerability factors

Ecosystems	very high/ strong	☑	very low/ non-existent

Comment:

Since FMNR creates habitat for wildlife, less cases of Human wildlife conflict will be experienced.

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☑ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☐ 0
☐ 1	☐ 1
☐ 2-5	☑ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☑ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☑ 201-500
☐ > 500	☐ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☑ 5001-10’000 USD	☐ 5001-10’000 USD
☐ 10’001-50’000 USD	☐ 10’001-50’000 USD
☐ 50’000-250’000 USD	☐ 50’000-250’000 USD
☐ > 250’000 USD	☐ > 250’000 USD

Duration since last disaster

- ☐ < 3 months
- ☑ 3-6 months
- ☐ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Technology

The primary protection target of FMNR is the soil, the secondary one to reduce the impact of adverse weather events on crops below them. Main hazards are winds, floods, landslides and droughts. The trees provide shade, improve and stabilize the soils and the water balance. They can't totally withstand heavy tornados, flash floods or long-lasting drought. However, they will always mitigate the destructive impacts of these harzards and reduce the risk of damage as the soil is less exposed and rain water will penetrate slowlier. The land-user can protect the trees against ainmal bites and should wisely choose which upcoming shrub should grow into a full tree. Thus wind breakers or contour hedges can be created, live fences and tree lines to reduce the removal of topsoil and protect upcoming crops. Field workers and livestock enjoy the protection against sun shine and heat. Some trees provide fruits and fodder for them.

IMPACTS

Additional benefits of the Technology

Safety (on-site)				
Safety of people	decreased	increased	*comment*	
Evacuation and shelter	decreased	increased	*comment*	
Safety of esp. vulnerable	decreased	increased	*comment*	
Early warning	decreased	increased	*comment*	
Safety of key documents	decreased	increased	*comment*	
Economic goods (on-site)				
Safety of individual housing	decreased	increased	*FNMR contributes to erosion control and reduces the risk of flooding; It also reduces the risk of winds blowing off roofs. Products from FMNR I.E wood support construction of good houses.*	
Safety of water stocks	decreased	increased	*FMNR contributes to water storage and charging of aquifers. Some tree species (in the acacia family) in an area are evidence of availability of underground water are thus easy to site places potential for drilling wells or boreholes.*	
Safety of seed/animal stocks	decreased	increased	*FMNR trees provide protection, shade, and organic matter. FMNR i an important source of forage for livestock, e.g. bees, cattle, goat etc. Hosts habitats for variety of wildlife*	
Safety of land assets	decreased	increased	*FMNR contributes to erosion control, Land with trees have higher economic value than without trees, FMNR confirms land ownershi since its regular maintenance and long-term benefits asserts ownership to an individual.*	
Safety of communal assets	decreased	increased	*FMNR reduces the risk of devastating flash floods. This can also help healing of the forming gullies. Grazing ground for livestock.*	
Other impacts (on-site)				
Safety of ecosystems	decreased	increased	*FMNR trees contribute to diversification of habitats and helps conserve biodiversity*	

Off-site impacts

None



Sensitisation of stakeholders about Farmer-Managed Natural Regeneration through a role play performed by young farmers. Most of the training is done on-site with practical demonstrations. Six fenced demonstration sites and other show cases serve as pilots for the whole community (Thomas Kalytta).

FMNR implementation approach (Kenya)

FMNR nyale

DESCRIPTION

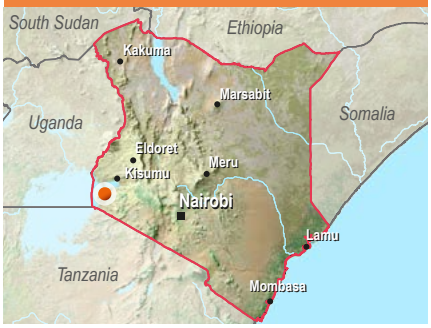
After consultations with local stakeholders, experts (from NEMA, ICRAF, KFS, Wildlife Kenya) and Homa Bay County Government representatives the Farmer Managed Natural Regeneration (FMNR) approach is being introduced by World Vision through a public funded project. The aim of the approach is to promote FMNR and sustainable land and natural resource management through disseminating the basic idea of regenerating trees.

The approach follows the basic principles of the Training of Trainers (ToT) concept i.e. key stakeholders and agents are trained to pass their knowledge on to others. Through a multi-stakeholder inception workshop all local stakeholders learn about the FMNR technology, its advantages and impacts. Representatives of the county and the national government are invited in order to get their support. Technical experts in agriculture are represented as well.

The Kenya Forest Service (KFS) and World Vision (WV) are the main actors in sensitising the local chiefs, school head teachers, Community Based Organisations (CBOs), self-help groups, farmers associations and individual farmers about FMNR, Disaster Risk Reduction and other topics. As a result farmers, teachers, schools management committee and CBO members register for the FMNR training, which is also carried out by KFS and WV. Selected farmers (those who are early adopters) are chosen as FMNR agents.

The registered FMNR practitioners (farmers, CBO members, school children, etc.) have to set aside a plot for FMNR application. They implement the technology. Each administrative unit (ward) establishes one FMNR committee under the lead of the local chief. The FMNR committee members (agents) are responsible for further dissemination for training and monitoring of the activities and maintaining the demonstration sites. They also organise exchange visits. They regularly report back to World Vision Development Facilitators. New FMNR farmers register with the committees. Research institutions (e.g. Maseno University) conduct studies to follow-up assumptions and to document change. The Community Disaster Management group is influenced by the FMNR committee and the County administration with regard to erosion control measures and gully restoration. The implementation is jointly monitored by the key stakeholders and documented by World Vision.

LOCATION



Location: Suba and Mbita Sub-Counties, Homa Bay County, Kenya

Geo-reference of selected sites
- 34.34453, -0.55986

Initiation date: 2014

Year of termination: n.a

Type of Approach
- ☐ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based

World Vision SWITZERLAND



A typical FMNR training event for practioners and FMNR agents (Thomas Kalytta).



During the inception workshop important stakeholders were invited to raise awareness on the FMNR technology and aquire "buy-in". The County Government, local chiefs, the Kenya Forest Service, many CBOs, local NGOs, school children and others were represented. A local fair was conducted where local products, improved cooking stoves, solar lamps and tree seedlings were offered (Thomas Kalytta).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The main objective of the approach is to promote FMNR and other natural resource management practices including agroforestry, crop diversification, sustainable rural energy sources and rehabilitation of highly degraded areas. It is also to utilise environmental education to advise about Disaster Risk Reduction in order to increase the resilience of the target population against adverse effects of climate change and natural disasters.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** enabling factors are the medicinal value of trees, herbs, the importance of places for worship and local rituals.
- **availability/ access to financial resources and services:** natural materials - which become more abundant under FMNR - can be used (wood, fruits, pods and grass) or sold, and money for firewood can be saved.
- **institutional setting:** some schools have surplus land which is ideal for FMNR and tree planting.
- **collaboration/ coordination of actors:** most partners are very supportive towards FMNR.
- **policies:** the Kenyan Government has issued a policy that 10% of the land should be covered by forest.
- **knowledge about SLM, access to technical support:** the Kenyan Forest Service officers are very supportive.
- **markets (to purchase inputs, sell products) and prices:** access to local markets is an advantage to sell the farm products e.g. honey is in demand, as is firewood; few inputs are needed apart from standard farming tools and gloves.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** livestock and fire put the FMNR sites at risk - fire is sometimes set to hilltops to attract rain. Some neighbouring farmers also complain about the return of fauna such as monkeys and snakes. Other people maintain old traditions (e.g. "clean agriculture"). Some men prevent women from participating in meetings, from planting trees or working with trees in their homesteads. These people are resistant to new ideas and approaches.
- **institutional setting:** sometimes even members of the school management board graze their cows where school children are attempting FMNR.
- **legal framework (land tenure, land and water use rights):** a clear legal framework is lacking, the ownership of "wasteland" needs to be clarified otherwise everybody tries to benefit from it - through over-grazing and charcoal burning for example.
- **land governance (decision-making, implementation and enforcement):** young farmers complain that they have not full rights over the family land, so they can only take up FMNR if their fathers agree. This hinders them from the immediate adoption of FMNR due to land ownership rights. Mostly young men are given their share of land at about 40 years of age. Hence this leads to delays in uptake.
- **workload, availability of manpower:** FMNR can create more work in the short-term, but the longer-term benefits are obvious. However, lazy people will not appear at training sessions because they might not have understood the benefits of the technology.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (smallholder farmers, registered FMNR agents, DRR committees):** The stakeholders were sensitised, received training, spread the message to peers and take part in joint monitoring.
- **community-based organisations (CBO and self-help groups, religious leaders, local NGOs):** take part in the training, mobilise their members to adopt the practice, make links to other stakeholders.
- **SLM specialists/ agricultural advisers (agricultural extension officers, Kenya Forest Service officers):** the KFS officers are involved in the technical training, while farmers have to go and access the extension officers in the towns to receive their advice
- **researchers (Maseno University):** measure the tree density, and the biodiversity change within the demonstration sites.
- **teachers/ school children/ students (teachers and school children):** practice FMNR and other innovative technologies.
- **NGOs (SEEK, Nature Kenya, Kenya Scouts):** teach children about the environment and nature.
- **private sector (The National Bank):** has been supplying seedlings for tree planting in Homabay County. This was done in collaboration with Kenya Scouts. Now they are showing interest in the FMNR technology: supplied seedlings in the initial stages
- **local government (local chiefs):** mobilise their communities.
- **national government (planners, decision-makers) (Homa Bay County Government):** very supportive, links to the different departments, provide matching funds, take part in joint monitoring.
- **international organisations (World Vision, ICRAF):** technical advisor, linkage to donors.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation	Specify who was involved and describe activities
initiation/ motivation		✓				Local farmers, DRR committee members and local chiefs were invited to take part in sensitisation sessions.
planning				✓		Local chiefs were very active in supporting the new technology by motivating local farmers to become registered.
implementation				✓		FMNR committees as technical support, also carry out monitoring and reporting
monitoring/ evaluation				✓		Done by FMNR committees, they receive data from all households jointly with other stakeholders and report back to the project management.
research			✓			Done by students of Maseno University by gathering primary data from demonstration sites every 6 months and compiling a biodiversity report.

Flow chart

1) Through a multi-stakeholder inception workshop all local stakeholders learn about the FMNR technology, its advantages and impacts. Representatives of the county and the national government (i.e. chiefs) are invited. Technical experts are represented as well.
2) The Kenya Forest Service and World Vision are the main actors in sensiting the local chiefs, school head teachers, CBOs, Self-help Groups, farmers' associations and farmers about FMNR, Disaster Risk Reduction and other topics.
3) As a result farmers, teachers, schools management committees and CBO members register for the FMNR training, which is also carried out by KFS and WV. Selected farmers (early adopters) are chosen as FMNR agents.
4) The registered FMNR practitioners (farmers, CBO members, school children, etc.) have to set aside a plot for FMNR application. They implement the technology.
5) Each administrative unit (ward) establishes one FMNR committee under the lead of the local chief.
6) The FMNR committee members (agents) are responsible for further dissemination of the technology, for training and monitoring of the activities and maintaining the demonstration sites. They also organise exchange visits. They report back to World Vision Development Facilitators.
7) New FMNR farmers register with the committees (multiplication).
8) Research institutions (e.g. Maseno University) conduct studies to follow-up assumptions and to document change.
9) The Community Disaster Management group is influenced by the FMNR committee and the county administration with regard to erosion control measures and gully restoration.
10) The implementation is jointly monitored by the key stakeholders and documented by World Vision.

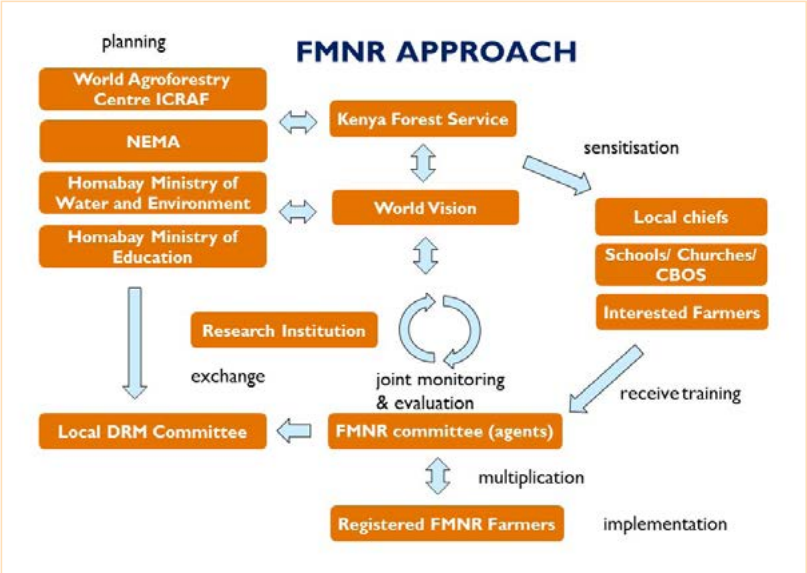


Figure: Thomas Kalytta

Decision-making on the selection of SLM Technology

Decisions were taken by

- [ ] land users alone (self-initiative)
- [ ] mainly land users, supported by SLM specialists
- [x] all relevant actors, as part of a participatory approach
- [ ] mainly SLM specialists, following consultation with land users
- [ ] SLM specialists alone
- [ ] politicians/ leaders

Decisions were made based on

- [x] evaluation of well-documented SLM knowledge (evidence-based decision-making)
- [x] research findings
- [ ] personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- [x] Capacity building/ training
- [x] Advisory service
- [x] Institution strengthening (organisational development)
- [x] Monitoring and evaluation
- [x] Research

Capacity building/ training

Training was provided to the following stakeholders

- [x] land users
- [x] field staff/ advisers

Form of training

- [ ] on-the-job
- [x] farmer-to-farmer
- [x] demonstration areas
- [x] public meetings
- [ ] courses

Subjects covered

FMNR, Natural Resource Management, Disaster Risk Reduction, Conservation Agriculture etc.

Advisory service

Advisory service was provided

- [x] on land users' fields
- [ ] at permanent centres

Comment: Done by the FMNR committees and development facilitators from KFS and WV.

Institution strengthening

Institutions have been strengthened/ established

- [ ] no
- [ ] yes, a little
- [ ] yes, moderately
- [x] yes, greatly

at the following level

- [x] local
- [ ] regional
- [ ] national

Describe institution, roles and responsibilities, members, etc.

Schools, churches, CBOs.

Type of support

- [ ] financial
- [x] capacity building/ training
- [ ] equipment

Monitoring and evaluation

Yes, joint monitoring and evaluation.

Research

Research treated the following topics

- [ ] sociology
- [ ] economics/ marketing
- [x] ecology
- [ ] technology

Comment: Maseno University, botanic and zoological studies, see separate reports.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [x] 2000-10000
- [ ] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Major donor: CThe initiative is funded by public donors and co-funded by the county government. For the approach including awareness, campaigns, training and monitoring as well as exposure trips 9230 USD were budgeted per year.

The following services or incentives have been provided to land users

- [x] Financial/ material support provided to land users
- [ ] Subsidies for specific inputs
- [ ] Credit
- [ ] Other incentives or instruments

Financial/ material support provided to land users

transport to the demo sites, for local farmers and stakeholders, food during the training materials for sensitisation, training & monitoring, accommodation only during exposure trips.

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *Yes, as it connects the different actors and levels.*				✓
Did the Approach enable evidence-based decision-making? *Evidence can be easily seen in the high rate of adoption among the land users of the area.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *Yes, because the land users have now access to local technical experts (FMNR agents) and demonstration farms.*				✓
Did the Approach improve coordination and cost-effective implementation of SLM? *Yes, greatly, as FMNR committees were established which coordinate the implementation in each ward in a cost effective way.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *No, the technology itself creates sources of income but the approach doesn't mobilise funds - only knowledge.*	✓			
Did the Approach improve knowledge and capacities of land users to implement SLM?				✓
Did the Approach improve knowledge and capacities of other stakeholders? *Yes, as it brings all relevant stakeholders together especially during initiation and monitoring.*				✓
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *There is quite some exchange and strengthening among the stakeholders: e.g. local NGOs, CBOs and churches.*				✓
Did the Approach mitigate conflicts? *Yes, a little, as it brings the local stakeholders together where they can talk and solve conflict e.g. between livestock keepers and farmers.*		✓		
Did the Approach empower socially and economically disadvantaged groups? *Yes, a little, as even farmers with very small plots can raise their voices and get ideas about how they can increase productivity.*		✓		
Did the Approach improve gender equality and empower women and girls? *Women are included in the discussions and training. They get empowered as the households produce firewood which saves a lot of time for collection. Some can also sell surplus firewood. High yield from farms with trees addresses food security. Ensuring there is food in a household is always the woman's responsibility.*			✓	
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *Yes, very much. During the discussions the young generation raise their voices and discuss with their fathers how to improve land-use and productivity.*			✓	
Did the Approach improve issues of land tenure/ user rights that hindered implementation of SLM Technologies? *Maybe a little, as these issues can be discussed during the gatherings.*		✓		
Did the Approach lead to improved food security/ improved nutrition? *Yes, since the approach led to the implementation of FMNR, and FMNR increases production and promotes diversification the land-use types.*			✓	
Did the Approach improve access to markets?	✓			
Did the Approach lead to improved access to water and sanitation? *Not the approach but the related technology.*	✓			
Did the Approach lead to more sustainable use/ sources of energy? *The FMNR campaigns are always integrated with promotions of solar and improved cooking stoves and the farmers' uptake of clean energy has improved through this. It thus leads to sustainable use of energy indirectly.*	✓			
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? *Yes, the approach increases the knowledge of the farmers about climate change and provides options to adapt better. They now appreciate indigenous tree species and their value and ability to survive in changing climatic conditions.*				✓

Main motivation of land users to implement SLM

- ✓ increased production
- ✓ increased profit(ability), improved cost-benefit-ratio
- ✓ reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- ✓ environmental consciousness
- customs and beliefs, morals
- ✓ enhanced SLM knowledge and skills
- ✓ aesthetic improvement
- conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: The local FMNR agents are well known in the community as environmentalists. They have demonstration sites on their farms. They took part in FMNR campaigns and training. Every visitor gets attracted by the technology. The agents introduce them. By applying the new technology their neighbours see and learn about FMNR as well. Even on other occasions in the community e.g funerals, religious meetings, ceremonies, the agents use the opportunity to reach more people with FMNR.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Sensitisation is integrated in community meetings or gatherings which bring many people together. Some of the meetings are called by local administrators who were the first champions of FMNR so this helps in infusing the knowledge through the sessions. Implementation is mostly by seeing and doing. Many farmers are consciously or subconsciously adopting FMNR as they see the sites in their neighbourhood. As the farmers visit each other alongside other engagements, FMNR monitoring continues since the people like to share new things with their friends and what they have learned.

Key resource person's view

- The ToT approach by working with FMNR agents and a local FMNR committee bridges the gap brought about by the absence of agricultural extension workers - only a few farmers actually visit them in their office in town. Also the day-by-day monitoring is done by the FMNR committee members and not by the project staff alone. A big advantage is the support of the Kenya Forest Service officers. They were ready to help with the on-site training. Crucial for the success of any approach is to involve and win over the local chiefs. They really have understood the benefits and even try to apply the technology themselves.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Lazy people who are not patient will not appear at training sessions because they don't understand the benefits of the technology. → *Continuous engagements and ensuring the sites are at strategic places where all farmer can see them easily.*
- These people can be convinced through the success of others. The approach seeks the support of all levels (county and local government, CBOs, local farmers, schools etc.) so it is quite time-consuming and requires skilled personal as facilitators. → *A donor needs to take this into account in terms of the available budget and life time of the project.*

Key resource person's view

- Some people still maintain old traditions (e.g. clean agriculture) and hinder women from participating in meetings, from planting trees or working on trees in their homestead. These people are more resistant to new ideas and approaches. → *The tradition is being demystified especially through church leaders and with more exposure. This might change their thinking.*

REFERENCES

Compiler: Thomas Kalytta - t.kalytta@worldvision.ch
Resource persons: Irene Ojuok (Irene_Ojuok@wvi.org) - SLM specialist; Thomas Kalytta (thomas_kalytta@wvi.org) - SLM specialist; William Sijenyi Onyiego - land user
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_733/
Linked SLM data: SLM Technology: Farmer Managed Natural Regeneration (FMNR) https://qcat.wocat.net/en/wocat/technologies/view/technologies_507/
Documentation was facilitated by: World Vision - Switzerland

Key references

Farmer-Managed Natural Regeneration Enhances Rural Livelihoods in Dryland West Africa, Weston, Peter, Reaksmey Hong, Carolyn Kabor & Christian A. Kull, Environmental Management Volume 55, Issue 6, pp 1402–1417,2015, ISBN 0364-152X00267-015-0469-1: Springer, USD 35

Re-greening the Sahel: farmer-led innovation in Burkina Faso and Niger, Reij, C.; Tappan, G.; Smale, M., in Millions fed: proven successes in agricultural development, 2009, ISBN 9780896296619: International Food Policy Research Institute.

Links to relevant information which is available online

Farmer Managed Natural Regeneration Hub: http://fmnrhub.com.au/

Der Waldmacher. Der Agrarexperte Tony Rinaudo verwandelt abgeholzte Steppen in grüne Wälder. Seine Methode könnte für Afrika bedeutender werden als Milliarden von Dollar Entwicklungshilfe: http://www.tagesanzeiger.ch/wissen/natur/der-waldmacher/story/26739960



Community rock catchment under construction in Ndikir village, Marsabit County, Kenya. The weir dams hold surface runoff when it rains, channeling the water into a piping system which leads the water into masonry storage tanks (Fredrick Ochieng).

Rock catchment (Kenya)

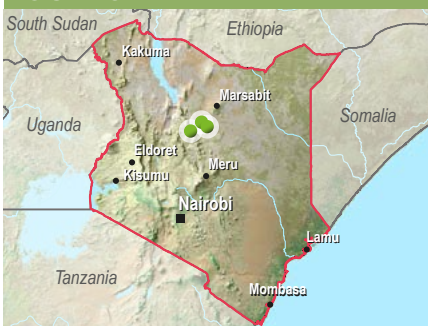
Rock catchment

DESCRIPTION

A rock catchment system is a water harvesting structure comprising a bare sloping rock surface (impounded area), a constructed concrete wall at a strategic point (weir), pipeline from weir to the storage tank(s), and water kiosk(s) connected to the tanks by pipelines.

Rock catchments are built on gently sloping outcrops on hillsides. The bare rockface is the surface from which rainwater is harvested. A weir is constructed at a strategic point for maximum collection towards the foot of the hill. The weir dams hold harvested water in the rock catchment and channels the water through a piping system to reservoirs, generally masonry tanks, located below the hill. A weir is usually a concrete wall constructed and reinforced with iron bars to give it adequate strength to withstand the weight of the dammed water. The length, height and thickness of a weir varies with the size and the slope of the rock catchment area. On average, a weir will be 10 metres long, 2 metres high and 0.5 metres thick. At the base of the weir, an infiltration box of approximately 1 square metre is constructed and filled from the bottom with fine sand, coarse sand and gravel (in that order) for the purpose of sieving out impurities before the water reaches the tanks. Metal piping is recommended for connecting the weir to the storage tanks downhill due to the high pressure exerted by the water. The piping distance ranges from 15 to 300 metres from the weir to the storage tanks. Provision is usually made for additional pipelines in case there is need for expansion of the system. At the bottom of the hill, masonry tanks are constructed, ranging from 100 cubic metres capacity, or greater, depending on the impounded area, population, and available resources. The pipes join the tanks through a control chamber meant for regulating water flow into the tanks. Adjacent to the tanks are water 'kiosks' where the community draws water. To gauge how much water is issued, a metre is fitted inside the kiosk. Metering the water helps in accountability and control. Construction of a rock catchment system needs heavy investment in materials - cement, quarry stones, ballast, iron bars, sand, hard core, water, metallic (galvanised iron) pipes and plumbing installations. Construction of the system is labour intensive in terms of both skilled and non-skilled personnel. The main purpose of the rock catchment system is to harvest, and store rainwater for domestic - and some livestock - use. In the case of the documented project, the benefiting communities are pastoralists who live in northern Kenya, a region characterised by chronic droughts, seasonal floods and acute water shortages. The water situation is aggravated by increasing drought frequency and severity. On the other hand, the little rain received has often been destructive downstream, cutting through roads and causing soil erosion due to high water velocity. During the dry periods when open water sources such as earth pans dry up, women travel long distances to search for water from hand dug shallow wells within dry seasonal riverbeds ('sand rivers').

LOCATION



Location: Implemented with three different communities in three location: Ndikir, Manyatta Lengima and Mpagas, Laisamis sub county, Marsabit County, Kenya

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 37.7047, 1.65635
- 37.52205, 1.73185
- 37.17072, 1.50377

Spread of the Technology: applied at specific points/ concentrated within a small area

Date of implementation: 2015

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

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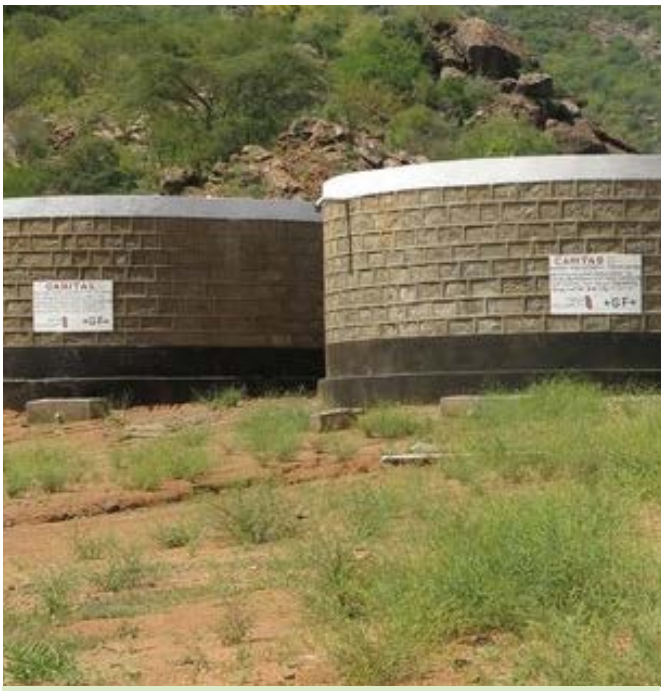
Front part of a weir showing pipelines (Joy Kivata).



Four masonry tanks each 50 cubic metres in Ndikir Rock catchment (Joy Kivata).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- ✓ conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Comment: The most common hazard in the region where the technology has been implemented is drought. The Technology aims at reducing the drought impacts among the pastoralists.

Land use



Grazing land - Main animal species and products: Camels, cattle, donkeys, goats, sheep Extensive grazing land: Semi-nomadism/ pastoralism

Comment: The pastoralists practice sedentary to semi-nomadism/ pastoralism lifestyles. However, even for those who are sedentary, they do not cultivate land. They entirely rely on livestock and relief assistance.

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: n.a.
Land use before implementation of the Technology: n.a.
Livestock density: The livestock owners constantly move with their livestock from one location to another.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wg: gully erosion/ gullying



water degradation - Hs: change in quantity of surface water, Hp: decline of surface water quality

SLM group

- cross-slope measure
- water harvesting
- pastoralism and grazing land management

SLM measures



structural measures - S5: Dams, pans, ponds, S7: Water harvesting/ supply/ irrigation equipment

TECHNICAL DRAWING

Technical specifications

A rock catchment consists of the following main components:

- impounded areas - vary, but commonly around 100 square metres.
- infiltration box - concrete box of approximately 1 square metre by 0.5 metre deep.
- weir - dam wall approximately 20 metres length, approx. 0.3-0.5 metres width, and 1.5 metres height; depending on the site, the catchment can store between 150 and 700 cubic metres behind the weir.
- pipes - galvanised steel pipes of varying diametres and length depending on catchment size and storage location and capacity tanks - varying capacities, of the same order of magnitude as the catchment storage capacity above the weir. Together, tanks and the open catchment can store some 10-20% of the annual precipitation falling over the rock collection area, which is enough to sustain water use during a normal year, but not during a year of exceptional water scarcity.

For further information: A sketch of typical rock catchment: http://www.climatetechwiki.org/sites/climatetechwiki.org/les/images/extra/media_image_3_22.png

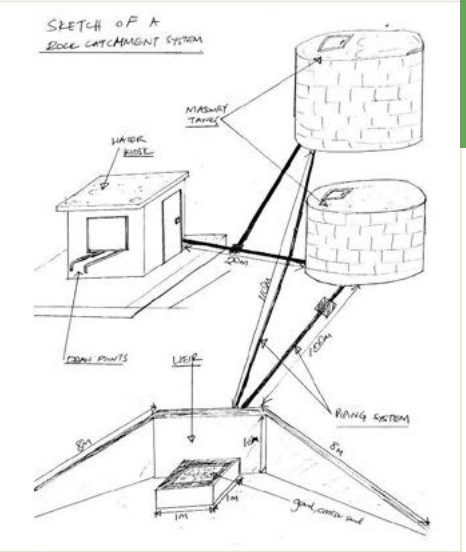


Figure: Fredrick Ochieng

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: A unit comprising **components of the technology**. The rock catchment technology has four components - **the weir, piping, tanks and water kiosk**).
- Currency used for cost calculation: **US Dollars**
- Average wage cost of hired labour per day: 15 USD per day for skilled labour and 3 USD per day for unskilled labour.

Most important factors affecting the costs

1. Availability of parts, whether they can be bought locally or from far.
2. Quality of parts.
3. Extent of the system exposed to vandalism and/ or destructive weather events.
4. Early detection of broken/ spoilt parts.

Establishment activities

1. Surveys - topographical, environmental impact assessment (Other measures; no specific time)
2. Drawings and bill of quantities (Other measures)
3. Procurement of materials (Management)
4. Recruitment of artisans (Management)
5. Start of construction works (Structural)
6. Continuous technical supervision and completion (Structural)

The key activities are not generally affected by the seasonality or any other type of timing with exception of procurement, for which it is essential to carry out when roads are passable.

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Skilled labour	Days	607.7	15	9115.5	0
Unskilled labour	Days	1973.0	3	5919	40
Construction material					
Construction materials for all the four components together	1 catchment system	1.0	75407	75407	0
Total costs for establishment of the Technology				**90441.5 USD**	

Maintenance activities

1. Periodic washing of tanks and scooping out of sand and silt at the weir (Structural; twice a year)
2. Repairs of broken parts - valves, pipes, taps etc. (Structural)

Rock catchment systems generally have minimal maintenance and repairs.

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Other					
Seasonal scooping of sand and silt from the weir	seasons/ year	2.0	100	200	100
Broken parts and repairs	lumpsum	1.0	300	300	0
Total costs for maintenance of the Technology				**500 USD**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [x] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [x] arid

Specifications on climate

There are two rainy seasons annually. The long rainy season starts in March to May and the short rains begin in October and end in December. There has been, however, variations in recent years mostly seen in terms of rainfall variability in distribution, amounts and seasonality.

Amount of rainfall received annually coupled with high rates of evapotranspiration cannot sustain crop farming.

Slope
- [ ] flat (0-2%)
- [x] gentle (3-5%)
- [x] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [ ] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [x] hill slopes
- [x] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [ ] medium
- [x] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [x] yes
- [ ] no

Occurrence of flooding
- [x] yes
- [ ] no

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [x] very poor
- [ ] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [x] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [ ] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [x] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [ ] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [x] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [x] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Water use rights
- [x] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor	✓			good
education	poor	✓			good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor		✓		good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor	✓			good
financial services	poor	✓			good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

drinking water availability	decreased							✓	increased	**Before SLM:** 600 cubic metres **After SLM:** 3800 cubic metres **Comment:** The community (almost every year) would need emergency water brought by truck. This is not so anymore.
drinking water quality	decreased							✓	increased	**Comment:** Borehole water was the only alternative source during the dry season. Water free of salt is now available and adequate for domestic use. They no longer use the highly saline water which has been reported to have adverse negative health effects. The harvested water is easy to treat for microbial contamination at the household level.
water availability for livestock	decreased				✓				increased	**Comment:** The harvested water from the rock catchment is mostly for household use.
water quality for livestock	decreased				✓				increased	
reduced conflicts over scarce water resources	decreased							✓	increased	
diversity of income sources	decreased	✓							increased	**Comment:** The time women used to spend in search of water has drastically reduced. They are now freer to engage and participate in social local networks and small businesses.
workload	decreased							✓	increased	**Comment:** Women have benefited hugely from this technology. Before the intervention, they would walk up to 5 kilometres in search of water for domestic use. This was particularly worse during drought or an extended dry spell as they also had to queue for many hours a day to get the water from available water points.

Socio-cultural impacts

health situation	worsened							✓	improved	**Before SLM:** Little water available for hygiene practices such as hand-washing. **After SLM:** Additional of 30 litres per day now available for good hygiene. **Comment:** The availability of water has dramatically improved hygiene.
community institutions	reduced							✓	improved	**Before SLM:** No properly functioning water management committee. **After SLM:** There is a vibrant and dedicated water management committee. **Comment:** The implementation of the technology has invigorated the community members and they have shown better organisation to prudently manage the water system. The management committee existed before the technology was implemented when they managed other water sources. However, the motivation then was low coupled with inadequate capacity to operate and maintain the water sources they had.
conflict mitigation	reduced						✓		improved	**Before SLM:** Several occurrences of conflict over water. **After SLM:** No more reason for conflict. **Comment:** The pastoral communities have, in recent decades, experienced resource-based conflicts. These conflicts happen at regional, communal and family scales. The communities and families benefiting from this intervention no longer have to fight over the resource because it is adequate.
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.	worsened							✓	improved	**Before SLM:** About 6 hours spent a day in search of water during the dry season. **After SLM:** A maximum of 30 minutes spent by a woman to fetch water. **Comment:** The technology benefits women most who traditionally are socially and economically disadvantaged. Now they have more time to engage in other profitable activities. The technology has also taken away the burden of proving water for the households, freeing them also for greater social engagement.

Ecological impacts

surface runoff	increased					✓			decreased	**Before SLM:** All rainwater from the rock was lost each time it rained as runoff. **After SLM:** About 3500 cubic metres of water is retained within the locality of the community. **Comment:** There is increased control of surface runoff reducing its damaging effects on soil, vegetation and infrastructure. However, this is on a minor scale.
groundwater table/ aquifer	lowered				✓				recharge	**Comment:** The rock catchments do not lead to increased groundwater recharge as all water is held on impermeable rock.
soil loss	increased					✓			decreased	**Comment:** Due to reduced amount of water owing from the hillside downstream, the ability of water to erode soil downstream is reduced (though at a low scale).
drought impacts	increased							✓	decreased	**Before SLM:** Water emergency supply at least twice a year during the two dry spells. **After SLM:** No single water trucking done in the last two years **Comment:** Water has been the worst affected livelihood necessity during drought events among the benefiting community. The impact had been acute water shortage leading to external emergency interventions. It also occurred that sometimes that when food aid was provided, the community would have no water to cook. There is no longer need for water emergency in these communities.

Off-site impacts

damage on public/ private infrastructure	increased	✓	decreased

Comment: The high velocity water from the hills has been a constant menace in cutting or blocking roads downstream with debris. The harvesting of water has reduced the impact of this water on some sections of the hilly landscape.

Benefits compared with establishment costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

seasonal temperature increase annual	not well at all	✓	very well	Season: dry season
rainfall decrease	not well at al	✓	very well	
seasonal rainfall increase	not well at al	✓	very well	Season: dry season

Climate-related extremes (disasters)

local rainstorm	not well at all	✓	very well
local thunderstorm	not well at all	✓	very well
drought	not well at all	✓	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 10-50%
- ✓ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- 0-10%
- 10-50%
- 50-90%
- ✓ 90-100%

Number of households and/ or area covered

This is a technology which is benefiting the entire community. At the time of project implementation the estimated total population was 1000 people.

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Relatively low cost of operation and maintenance.
- The technology does not require specialised technical skills for day-to-day operations.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Relatively high initial investment cost that is unlikely to be raised by communities themselves. Without external financial support it is therefore unlikely that the system can be expanded when water needs increase. → *1. A long term plan that includes savings from fees from water sales. 2. Funds could also potentially be acquired from the county governments or NGOs.*
- There are not too many suitable rock catchments where it can be applied. → *A proper survey whether there are additional sites for rock catchments needs to be done. Inclusive comprehensive project could be implemented here.*

REFERENCES

Compiler: Fredrick Ochieng - fochieng@caritas.ch
Resource persons: Fredrick Ochieng (fochieng@caritas.ch(- SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_580/
Linked SLM data: SLM Approach: Partnership with beneficiary communities in project implementation: https://qcat.wocat.net/en/wocat/approaches/view/approaches_597/
Documentation was facilitated by: CARITAS

Key references

A Handbook of gravity-flow water systems for small communities; Thomas D. Jordan Junior; 1980; 978 0 94668 850 0: CACH office library, Nairobi

Links to relevant information which is available online

Rock Catchments for Community Water Supply in Eastern Equatoria State, South Sudan: http://waterconsortium.ch/wp-content/uploads/2016/09/Poster_Rock-Catchments_Caritas_South_Sudan_2016.pdf

Adopting locally appropriate WASH solutions: a case study of rock catchment systems in South Sudan: http://wedc.lboro.ac.uk/resources/conference/37/Leclert-1935.pdf

Water from Rock Outcrops by Erik Nissen-Petersen 2006 (DANIDA)



A meeting held with the beneficiary community in Manyatta Lengima to review and plan Rock Catchment Project activities (Fredrick Ochieng).

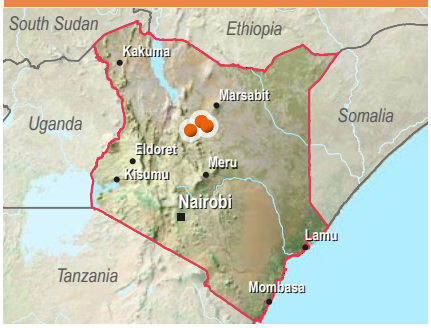
Partnership with beneficiary communities in project implementation (Kenya)

DESCRIPTION

The approach focuses on community engagement on a partnership basis. The model is a departure from the traditional approach where the community is reduced to being a beneficiary of project services without substantive responsibility.

The main purpose of the approach is to enhance project ownership, while fostering capacity for management of outcomes. Ultimately, the sustainability of project results is only achievable given community empowerment and meaningful participation. The approach also aims at cost-effectiveness as the community is required to contribute substantially in terms of locally available materials, labour and sometimes cash. Community mobilisation and capacity building is central to ensure that the community is prepared to undertake their roles and responsibilities. Mobilisation happens through discussions, sometimes aided by applying participatory tools and methods. Capacity building is done through workshop-type and/ or on-the-job training. It is recognised that communities have relevant indigenous knowledge and skills which can inform the project design, planning and implementation of activities. To enhance local skills, selected community members were trained while working alongside hired skilled artisans during the construction of the rock catchment system. The aim is to prepare and equip local people with the ability to operate and maintain such systems. Others are trained to promote hygiene and sanitation. The project was designed based on a preliminary assessment. The assessment, besides uncovering water and hygiene needs, also identified three areas/ communities which had rock catchment potential - Ndikir, Manyatta Lengima and Mpagas. Initial meetings were carried out with support from community leaders and the local government administrators (chiefs). During the meetings the project was explained and discussed in relation to the community needs and the roles for all stakeholders - CARITAS Switzerland (CACH), the community, government and leaders. Agreed roles and responsibilities were drafted, and formed the main part of the Memorandum of Understanding (MoU) between CACH and the community. The MoU was signed before the entire community to ensure collective ownership and to formalise the relationship between CACH and the project. At the county and sub-county levels, the stakeholders are provided with progress updates, and engage with government and other leaders. The local leaders have proved important in helping with community mobilisation and addressing areas of concern wherever issues arise. The approach leaves the community better motivated and with a desire to manage the project for posterity. The community has appreciated that the project ended with a number of its members having acquired the skills required for operations and maintenance. Above all, they are proud to have significantly contributed to the successful implementation of the project. This is especially noteworthy since, initially, the community was opposed to the idea that they had to contribute so much, as before they had mostly received assistance without any requirement to contribute.

LOCATION



Location: Implemented with three different communities in three locations: Ndikir, Manyatta Lengima and Mpagas, Laisamis sub county, Marsabit County, Kenya

Geo-reference of selected sites

- 1.65635°, 37.7047°
- 1.73185°, 37.52205°
- 1.50377°, 37.17072°

Year of termination: 2015

Type of Approach

- ☐ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based

CARITAS Schweiz Suisse Svizzera Svizra



Artisans together with community members - who are trained in construction methods before they are given work (Catherine Wanjihia).



Women in Manyatta Lengima celebrate the notable achievement of completing the rock catchment water harvesting system (Alex Voets).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Community mobilisation. Active community participation and ownership of the project and outcomes.
Sustainability of project outcomes.
Enhanced skills and capacity to manage the Technology.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **institutional setting:** The institutional setting, especially the traditional authority of elders, was supportive during implementation. Once the elders were convinced about certain decisions beneficial to the project, it was always easier for the rest of the community members to rally behind.
- **collaboration/ coordination of actors:** The Approach requires that stakeholders (other non-state actors and government) coordinate well so that approaches employed by all are complementary and build sustainable results. It has been the situation previously that approaches commonly disempower communities. In this case it was concluded that good coordination and collaboration would enhance sharing and learning across the actors and minimise such programming pitfalls.
- **legal framework (land tenure, land and water use rights):** Land tenure in the northern Kenya is mostly communal. This was an enabling factor so that there were no complex and expensive legal requirements to construct a rock catchment water system. Had land been adjudicated and subdivided, there would have been a need for negotiations and legal procedures to be carried out with the owners of the land where the rock catchment was to be located.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The community was accustomed to receiving food and non-food handouts. This culture was a major hurdle in working with communities under conditions where they were expected to make a substantial contribution towards the project activities.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities:** The project was implemented with participation of the communities who are the local land users. The community's role was to ensure that locally available materials were delivered to the site of construction, to promote hygiene and sanitation, provide unskilled labour, keep records of all construction materials, and look after the security of workers and construction materials on site.
- **SLM specialists/ agricultural advisers:** CARITAS had a technical team of three who were based within the project location in the field. This team was supported through experts in the office in Nairobi. The technical team guided all project activities such as community organisation/ mobilisation, construction of infrastructure as well as hygiene and sanitation promotion.
- **local government (Chiefs, Members of County Assembly, Ward administrators):** Opinion leaders were crucial in the process of community mobilisation and following-up the commitments made by the community under the signed MoU.
- **national government (planners, decision-makers):** Coordination with other development agencies and government departments at the county level.
- **international organisation (CARITAS Switzerland):** Overall leadership in project planning, implementation and supervision.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation				✓	
monitoring/ evaluation				✓	

Specify who was involved and describe activities

Planning for project activities was jointly carried out between the community and the specialists.

More technical planning was done as advised by the technical project team. Planning for day to day field activities during implementation was jointly done with the community.

Community participation was more interactive in planning for specific project activities. However, there were specific tasks which required hired labour and by common agreement the community provided such paid labour.

Monitoring with the community was mainly done during project reflection/ review meetings. Monitoring in this respect was more-limited to evaluation of progress and timeliness of activities.

Flow chart

The flow chart summarises the Approach's key components, activities and steps for community mobilisation, capacity building and stakeholders engagement. The stakeholders include the relevant government departments - water, health, environment, drought management - and non-state actors in the county. There is a monthly forum known as the County Steering Group (CSG) which brings together all the heads of government departments and NGO representatives at the county level. Similar forums also take place at the sub-county level.

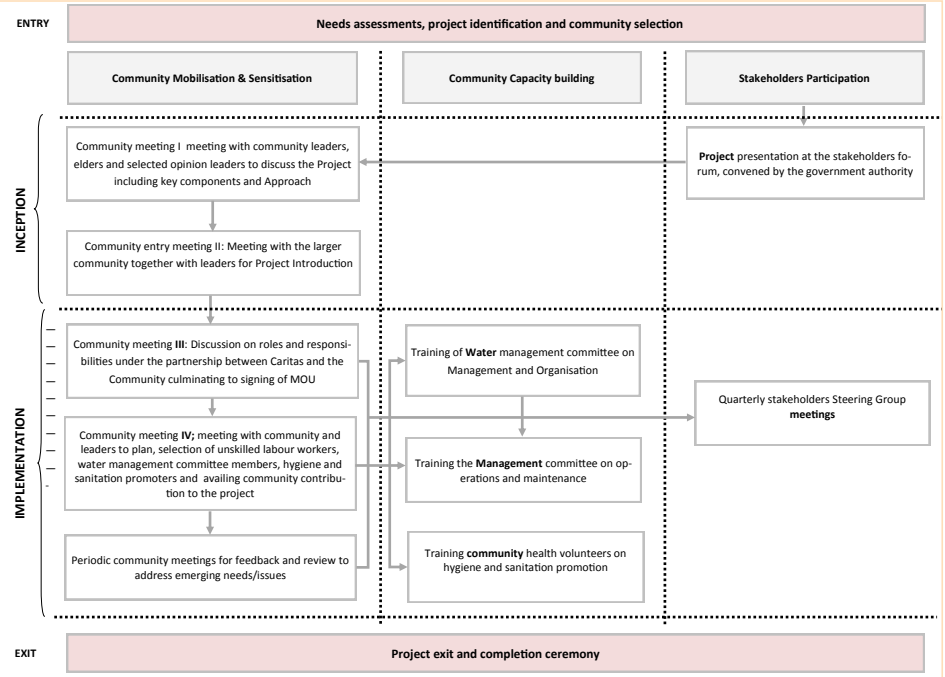


Figure: Fredrick Ochieng

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- ✓ research findings
- ✓ personal experience and opinions (undocumented)
- ✓ government policies

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- Monitoring and evaluation
- Research

Capacity building/ training

Training was provided to the following stakeholders
- ☑ land users
- ☑ field staff/ advisers

Form of training
- ☑ on-the-job
- ☐ farmer-to-farmer
- ☐ demonstration areas
- ☑ public meetings
- ☐ courses

Subjects covered
Basic construction skills, management of the water system under the rock catchment, hygiene and sanitation promotion.

Advisory service

Advisory service was provided
- ☑ on land users' fields
- ☐ at permanent centres

Comment: NGO services helped to set up the pasture management system by facilitation of process through visual aids like watershed maps showing soil quality, slope gradients, vegetation cover, etc. Together with the number of livestock in the community the fodder needs of the community was established and guided the discussion to identify pastures, define rotational schemes, identify potential options of water points on daily pastures, identify arable land to cultivate fodder, identify and demarcate roads for herds to reach daily pastures.

Institution strengthening

Institutions have been strengthened/ established
- ☐ no
- ☐ yes, a little
- ☑ yes, moderately
- ☐ yes, greatly

at the following level
- ☑ local
- ☐ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.
The Approach led to establishment of Water Management Committees (WMC). The committees have been trained and equipped to manage the systems.

Type of support
- ☑ financial
- ☑ capacity building/ training
- ☑ equipment

Further details
One key lesson from this and other projects is that one-off training courses are rarely effective even if properly done. Continuous support/ follow-up is necessary to maintain the skills and knowledge acquired.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component
- ☐ < 2000
- ☑ 2000-10000
- ☐ 10000-100000
- ☐ 100000-1000000
- ☐ > 1000000

Precise annual budget: 1000.0

Comment: Internal organisational funding and external donors.

The following services or incentives have been provided to land users
- ☑ Financial/ material support provided to land users
- ☐ Subsidies for specific inputs
- ☐ Credit
- ☐ Other incentives or instruments

Financial/ material support provided to land users
CARITAS procured the bulk of construction materials while the community contributed locally available materials - sand and hardcore.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *Community participation was initially a new concept in this region. Through various meetings, persistence and flexibility community participation improved and was achieved during the project period.*	☐	☐	☐	☑
Did the Approach enable evidence-based decision-making? *Due to the nature of working with the community, it was always possible to review certain elements of project activities based on learning.*	☐	☐	☑	☐
Did the Approach help land users to implement and maintain SLM Technologies? *The Approach's aim was to build the required capacity of the community members to better manage the Technology well after the project ended.*	☐	☐	☐	☑
Did the Approach improve coordination and cost-effective implementation of SLM? *The community's contribution in labour and locally available materials (hardcore and sand) significantly reduced the cost of construction. These are materials that otherwise would have been procured from far off at a much higher cost.*	☐	☐	☐	☑
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The implementation was funded with support aimed for drought recovery. The country had just gone through a major drought. The Approach, however, focused more on mobilising communities towards meaningful participation by providing local available resources such as hardcore, sand, and unskilled labour.*	☑	☐	☐	☐

Did the Approach improve knowledge and capacities of land users to implement SLM? ☐☐☐☑
A significant element of the Approach was capacity building which was achieved through on-the-job and workshop training for the selected community members.

Did the Approach improve knowledge and capacities of other stakeholders? ☐☐☑☐
The project was implemented with close involvement of county government officials and other development organisations. There have been requests by other development actors in the region wanting to know more about how CARITAS Switzerland succeeded in working with the communities and achieved these impressive results.

Did the Approach build/ strengthen institutions, collaboration between stakeholders? ☑☐☐☐
The project's mandate was limited to community institution capacity building. Beyond community empowerment the Approach did not target capacity raising of other stakeholders.

Did the Approach mitigate conflicts? ☐☐☐☑
The region within which the project was implemented has resource-based conflicts, mostly overwater and pasture land. The Approach led to successful implementation of the Technology which reduces pressure on water resources. In addition, the management of the newly constructed water points ensures that community members benefit equally.

Did the Approach empower socially and economically disadvantaged groups? ☐☐☐☑
Women are the main beneficiaries of the Approach. They were more active than men in offering semi-voluntary labour. Their motivation was that they bear the greater burden as it is their responsibility to provide household water.

Did the Approach encourage young people/ the next generation of land users to engage in SLM? ☑☐☐☐
Youth participation was minimal due to cultural barriers. Young men do not participate in most community activities. They are expected to have minimal contact with the rest, and especially women hence most of their time they are in the bush.

Did the Approach improve issues of land tenure/ user rights that hindered implementation of SLM Technologies? ☑☐☐☐
The land tenure system in the area where the Approach was implemented is communal.

Did the Approach lead to improved food security/ improved nutrition? ☐☐☑☐
It is expected that nutritional status will improve with increased access to better quality water. However, no survey was carried out to confirm this assumption.

Did the Approach improve access to markets? ☐☐☑☐
Community members who initially would spend substantial amount of time to search for water, have more time to engage in trade and other diversified sources of income.

Did the Approach lead to improved access to water and sanitation? ☐☐☐☑
There is improved access to water. The three benefiting communities no longer need emergency water supplies. However, the impact on sanitation was less than satisfactory.

Did the Approach lead to more sustainable use/ sources of energy? ☑☐☐☐
The project's mandate under which the Approach was implemented was limited to water and sanitation.

Did the Approach improve the capacity of the land users to adapt to climate change/ extremes and mitigate climate related disasters? ☐☐☐☑
Increased water supply has greatly increased community resilience to droughts. With prudent management of the water harvested, they have successfully avoided negative drought impacts.

Did the Approach lead to employment, income opportunities? ☐☐☑☐
There is no direct employment except that the community members can now engage more in other rewarding businesses.

Main motivation of land users to implement SLM

- ☐ increased production
- ☐ increased profit(ability), improved cost-benefit-ratio
- ☐ reduced land degradation
- ☑ reduced risk of disasters
- ☑ reduced workload
- ☐ payments/ subsidies
- ☐ rules and regulations (fines)/ enforcement
- ☐ prestige, social pressure/ social cohesion
- ☐ affiliation to movement/ project/ group/ networks
- ☐ environmental consciousness
- ☐ customs and beliefs, morals
- ☐ enhanced SLM knowledge and skills
- ☐ aesthetic improvement
- ☑ conflict mitigation
- ☑ improved access to water

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- ☐ no
- ☑ yes
- ☐ uncertain

Comment: The Approach strongly focused on capacity building, community empowerment and strengthened institutions. It is expected therefore that they will sustainably manage the Technologies that have been constructed.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- The Approach provides greater ownership of the Technology thus leading to better equipped community groups with skills for operations and maintenance. The Approach galvanises a community towards a common goal hence promotes cohesion and better organisation.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- It takes time to achieve the community's buy-in so that they can adequately fulfil their obligations. This is particularly the case in a region where varied development Approaches have been implemented, most of which create dependency and discouraged self-initiative. → *This can be changed through long term engagement processes with all stakeholders such as county government and NGOs to advocate for approaches that foster community empowerment.*

REFERENCES

Compiler: Fredrick Ochieng - fochieng@caritas.ch
Resource persons: Fredrick Ochieng (fochieng@caritas.ch) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_597/
Linked SLM data: SLM Technology: Rock catchment https://qcat.wocat.net/en/wocat/technologies/view/technologies_580/
Documentation was facilitated by: CARITAS

Key references

Handbook of gravity-flow water systems for small communities; Thomas D. Jordan Junior 1980; 978 0 94668 850 0: CARITAS Switzerland office, Nairobi

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		☑			
Drought		☑			
Biological hazards					
None					
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Approach was applied

				Comment:
Exposure				
of private assets	very high/ strong	☑	very low/ non-existent	*Livestock highly exposed to droughts.*
of community infrastructure	very high/ strong	☑	very low/ non-existent	*Critical roads, bridges often are washed away due to flash floods.*
Economic factors				
Income	very high/ strong	☑	very low/ non-existent	*Main income source is livestock sales.*
Savings/stocks	very high/ strong	☑	very low/ non-existent	*Pastoralists keep their wealth in form of livestock.*
Social factors				
Access to public services	very high/ strong	☑	very low/ non-existent	*With already poor infrastructure and remoteness, floods aggravate the situation.*
Physical factors				
Robustness of infrastructure	very high/ strong	☑	very low/ non-existent	*Every rainy season roads are cut off by floods.*

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☑ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☑ 0
☐ 1	☐ 1
☐ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☑ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☑ 0% (no damage)	☑ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10’000 USD	☐ 5001-10’000 USD
☑ 10’001-50’000 USD	☐ 10’001-50’000 USD
☐ 50’000-250’000 USD	☑ 50’000-250’000 USD
☐ > 250’000 USD	☐ > 250’000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☑ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Approach

The aim is to harness social capital, build management capacity and enhance ownership of the constructed system for water harvesting while fostering practices that enhance preparedness to drought and water shortage.

IMPACTS

Additional benefits of the Approach

Safety (on-site)				**Comment:**
Safety of people	decreased	☐☐☐☐☐☑☐	increased	*Safer water is available for the community.*
Economic goods (on-site)				
Safety of seed/animal stocks	decreased	☐☐☐☑☐☐☐	increased	*More water is available due to good management practices.*

Off-site impacts

None



Disability-inclusive, flood resilient cluster village (Shahidul Islam, Project Officer, CDD, Gaibandha).

Disability-inclusive, flood resilient cluster village (Bangladesh)

Protibondhita Bandhob Bonna Sohisnu Gucca Gram

DESCRIPTION

The inclusive, flood-resilient cluster village provides safe housing, food security and income generation for multiple families, including persons with disabilities, in a highly flood prone area of Gaibandha District in northern Bangladesh. The land is raised above the flood level, and is further protected by deep rooted fruit trees to prevent soil erosion and provide income for the land users.

The inclusive, flood-resilient cluster village concept was introduced in a rural area with a high risk of recurring monsoon floods. The purpose of the technology is to provide safe housing, safe shelter for livestock, food security and income generation for ten families, including persons with disabilities. The main components of the technology are: 1) The raising of a plot of land by seven feet (just over two metres), that is three feet (one metre) above the expected highest flood levels. Soil is banked up to encircle a 30000 square feet (roughly 50mx57m) piece of land and then the area within is filled with sand collected from a nearby riverbank. A one-foot (30 cm) layer of soil is added to cover the entire area. 2) The raised land is protected from soil erosion during floods by planting a combination of deep-rooted fruit and medicinal trees around the border of the raised fruit land. The trees include deep rooted types including a medicinal species, *Azadirachta indica*, locally known as "Neem". In addition, the slope of the border area is covered by grass turf to protect the soil. Two types of deep-rooted and flood resistant grasses are used. A drainage system is installed to facilitate water runoff. 3) The planting of homestead vegetable gardens for each household, averaging about 60m^2 each. The diverse and multiple vegetables provide for a summer and a winter harvest. Together with the fruit trees, the vegetable garden provides food security during prolonged flooding. They also provide improved nutrition and income generating opportunities. 4) Making the village accessible for persons with disabilities through different accessibility measures, including the construction of a ramp, connecting the cluster village entrance with the road, and of accessible common Water-, Sanitation- and Hygiene (WASH) facilities, including a latrine, deep borehole water source and water storage tank. 5) Installation of a solar panel to ensure uninterrupted, flood-resilient power supply. The level of power supply is sufficient to ensure coverage of electricity needs during the flood season, when regular supply is around 15% below the annual average. The cluster village was pioneered as part of a Disaster Risk Reduction project by CDD (Center for Disability in Development) from Bangladesh, with the support of CBM (Christoffel Blindenmission), an international development organisation and funded by a donor from Germany. The main cost for inputs are provided to the land users by the project, including rent of construction machinery, payment for labour, soil and construction material for the ramp and WASH facilities. The land users contribute labour and seedlings for the planting of the border trees and the homestead source of food and income, providing food security and improved nutrition. The Neem trees provide medical and hygiene products from their branches and leaves. The cluster village is used as a safe space for the land users and other members of the community and their livestock during floods. Land users who are persons with disabilities or elderly benefit from the accessible infrastructure. With multiple families sharing land, the cluster villages provide optimal utilisation of land resources. An additional benefit mentioned by land users is that the joint use by multiple families has led to a more progressive social culture.

LOCATION



Location: Horipur Union, Sundargonj Sub district, Gaibandha District, Bangladesh

No. of Technology sites analysed: single site

Geo-reference of selected sites
• 89.56861, 25.53408

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: 2016

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

cbm
christoffel blindenmission
gemeinsam mehr erreichen



Ramp connecting the main entrance of the cluster village to the road (Shahidul Islam).



Deep rooted Mango trees planted around border of the raised land of the cluster village (Shahidul Islam).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Settlements, infrastructure - Settlements, buildings

Water supply

- rainfed
- ✓ mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology:
Livestock density: Livestock are available in every household

Purpose related to land degradation

- ✓ prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wr: riverbank erosion

SLM group

- improved ground/ vegetation cover
- cross-slope measure
- home gardens

SLM measures



vegetative measures - V1: Tree and shrub cover, V2: Grasses and perennial herbaceous plants



structural measures - S7: Water harvesting/ supply/ irrigation equipment, S8: Sanitation/ waste water structures, S9: Shelters for plants and animals, S10: Energy saving measures



management measures - M1: Change of land use type, M2: Change of management/ intensity level, M6: Waste management (recycling, re-use or reduce)

TECHNICAL DRAWING

Technical specifications

The drawing shows the layout of the disability-inclusive, flood resilient cluster village. The components of the technology are: Raised land/ plinth: 1) Purchase of land of a total area of 18,000 square feet (ca. 40 m x 40 m). Land ownership transferred to joint ownership of 10 families. 2) Collect 15000 cubic feet (425 m^3) of soil from different locations in the community. The soil is donated by members of the community, who are either related to the land users of the cluster village or donated in support of the construction of a safe space which can be used by the community during floods. 3) Banking up of 3 feet (90 cm) of soil along the borders of the land. 4) Filling of area with 140000 cubic feet (nearly 4000 m^3) of sand, extracted from a nearby riverbed with a rented sand extraction machine, raising the land to 6 feet (185 cm). 5) Covering the entire area with one additional foot of soil, raising the land to 7 feet (just over 2 metres), which means 3 feet (90 cm) above the maximum expected flood levels. Soil protected through deep-rooted trees: 1) Planting of deep-rooted and light-rooted fruit trees, surrounding the entire border of the raised land. The trees include deep rooted fruit trees like mangos, black berry, jackfruit, guava, coconut and areca nut, light-rooted fruit trees like banana and papaya, a deep-rooted medicinal tree, "Neem" and the light-rooted "Dhol Kalmi" tree (pink morning glory). The number of deep-rooted trees is 100, with a spacing of around 5 feet (1.5 m). They are planted to cover the entire perimetre of the raised land. In between the deep-rooted trees, 60 light-rooted trees are planted. In front of the deep-rooted trees, 60 bamboo bushes are planted to provide additional protection from wind and rain. 2) Turfing of the entire slope surrounding the cluster village with two flood resistant grasses: Durva (*Cynodon dactylon*) and Catkin grass (*Saccharum spontaneum*). 3) Installation of a central drainage system with 15 plastic pipes ensuring water runoff from the wastewater pond.

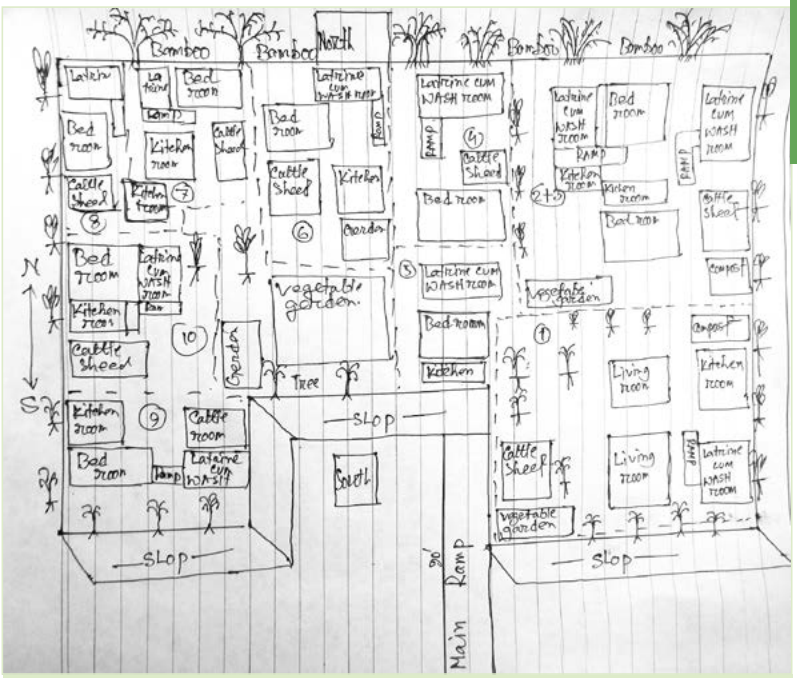


Figure: Shahidul Islam

Road access through ramp: The connecting ramp of the cluster village is 90 feet (just under 30 metres) in length, and 6 feet (nearly 2 metres) in width. There are five landing points on this ramp with smooth slopes. The construction material comprises bricks, cement, sand, polythene and red oxide for colour contrast, which is appropriate for visually impaired persons. There is a narrow border on both sides of the ramp for safe movement of a wheel chair user.

Accessible household water and sanitation facilities: A latrine and wash-room are constructed for every house in the cluster village, following universal design standards. Latrines are connected to the wash room and the main house through ramps. The latrines are pit latrines with a railing fixed to the wall on one of the latrine and a foldable toilet seat fixed to the wall behind the latrine. The entrance to the wash room is wide enough for wheelchair access. The water system for the latrine and wash room is provided from a water tank which is also connected to the main house for provision of drinking water. The tank is filled by hand pump which functions with minimal hand pressure. The WASH facilities are accessible and usable by everyone.

Home vegetable gardens: Every household has an individual homestead vegetable garden where land users cultivate seasonal vegetables year-round. Gardens vary in size averaging about 60m^2 in size and are surrounded by bamboo fencing. The land owners use organic fertilizer/ compost and water from the hand pumps for vegetable production. They make compost in pits behind their houses.

Solar system: A mini solar system is installed on the roof of each house by using a small panel with a 12-volt battery. Each system has the capacity of providing power for light for 8 hours. An introduction to system maintenance was given to the land users by the provider of the solar system.

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Cluster village** volume, length: **18000 square feet of land**)
- Currency used for cost calculation: **Bangladeshi Taka**
- Exchange rate (to USD): 1 USD = 80.0 Taka.
- Average wage cost of hired labour per day: 300 Taka.

Most important factors affecting the costs

Market fluctuation and scarcity of goods in the flood season.

Establishment activities

1. Selecting the place for cluster village construction (Management)
2. Establish collaboration with 10 families who will become land users (Management)
3. Land Raising & Ramp construction (Structural)
4. Reconstruction of the existing houses of the land users on the raised land (Structural)
5. Planting of deep- and light-rooted fruits trees, bamboo bushes and grass turfing along the boundary (Agronomic)
6. Install accessible water & sanitation system (Structural)
7. Establish homegarden in front of each house (Vegetative)
8. Install mini solar system for each house (Other measures)
9. Prepare livestock shed for each house (Structural)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Land raising, tree planting and turfing on slope	person days	290.0	300	87000	10
Ramp construction	person days	115.0	350	40250	10
House reconstruction and WASH facilities	person days	200.0	400	80000	10
Solar system installation	person days	10.0	300	3000	10
Equipment					
WASH equipment (latrine, magic pump, water tank, pipes, switch, pillars and other)	pieces	10.0	46658	466580	0
Solar system	pieces	10.0	6300	63000	0
Plant material					
Deep rooted trees	pieces	100.0	40	4000	100
Seed for vegetable	KG	5.0	1000	5000	100
Sapling purchase	pieces	100.0	50	5000	100
Light rooted tree	pieces	60.0	30	1800	
Fertilizers and biocides					
Organic fertilizer (compost)	KG	600.0	10	6000	100
Construction material					
Rent for shallow machine for sand extraction	Daily rent	10.0	28800	288000	0
Grass turfing	square feet	15000.0	10	150000	0
Allowance for house reconstruction material	House	10.0	2000	20000	0
Ramp construction	Piece	1.0	125750	125750	0
Other					
Project management (monitoring and support)	persons-days	180.0	2400	432000	0
Total costs for establishment of the Technology				**1777380 Taka**	

Comment: Labour for tree plantation, homestead gardening & house reconstruction is contributed by the land users.

Maintenance activities

1. Turfing: Repair leakages, replace grass etc. (Structural; before onset of rains)
2. Tree maintenance: Cutting branches, manure of roots etc. (Agronomic)
3. Vegetable gardening (Vegetative)
4. Housing repairs (Structural)
5. Water and Sanitation system servicing and repairs (Management)
6. Solar system maintenance (Management)
7. Village group meeting for decision making and conflict resolution (Management)
8. Organic composting/ fertilizer production (Other measures)

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
House repairs	person days	10.0	300	3000	100
Ramp repairs	person days	10.0	300	3000	100
Plingth raising and plantation	person days	30.0	300	9000	100
Solar system servicing by technical experts	unit	10.0	500	5000	100
Plant material					
Seed for vegetable gardening	Kg	5.0	1000	5000	0
Construction material					
Soil for slope maintenance	square feet	5000.0	10	50000	0
Sand for slope maintenance	Kg	5000.0	2	10000	0
Total costs for maintenance of the Technology				**85000 Taka**	

Comment: Land users contribute 100% of the maintenance cost.

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [x] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Heavy rainfall is one of the causes of flooding.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [x] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [x] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [x] yes
- [ ] no

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [x] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [x] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor	✓			good
education	poor		✓		good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor	✓			good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor			✓	good
financial services	poor	✓			good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production	decreased					✓		increased	**Comment:** Fruit and vegetable production increased after introduction of the cluster village. Because of decreased loss of home and property during floods, labour is freed for crop production which increases overall crop production in the wider area.
crop quality	decreased					✓		increased	**Comment:** Fruit and vegetable quality is improved because of availability of Irrigation.
animal production	decreased					✓		increased	**Comment:** Livestock mortality rate is reduced because of the 'safe space' in the cluster village.
risk of production failure	decreased						✓	increased	**Comment:** Homestead vegetable garden and fruit tree plantation above the flood level has significantly reduced risk of production failure.
product diversity	decreased					✓		increased	**Comment:** The flood-protected homestead vegetable garden allows for higher product diversity.
production area (new land under cultivation/ use)	decreased						✓	increased	**Comment:** Increased availability of flood-protected land for vegetable gardening.
energy generation (e.g. hydro, bio)	decreased						✓	increased	**Comment:** Energy supply was not available before installation of solar panel.
drinking water availability	decreased					✓		increased	**Comment:** Installation of deep tube wells.
drinking water quality	decreased						✓	increased	**Comment:** Significantly higher water quality during floods, because of flood protected water source in cluster village.
water availability for livestock	decreased					✓		increased	**Comment:** Installation of deep tube wells. Irrigation available to land users after installation of deep tube well.
irrigation water availability	decreased						✓	increased	**Comment:** Demand for irrigation water increased because of vegetable garden.
demand for irrigation water	decreased					✓		increased	**Comment:** Increase of farm income through selling of fruit and vegetables.
farm income	decreased					✓		increased	**Comment:** Additional income source through selling of fruit and vegetables.
diversity of income sources	decreased				✓			increased	**Comment:** Decreased income disparities between the land users of the cluster village due to fruit and vegetable production available to all land users. Decreased income disparities between land users of the cluster village and other members of the community because of the reduction of loss from flood damage.
economic disparities	decreased					✓		increased	
workload	decreased				✓			increased	**Comment:** Somewhat increased workload for maintenance of technology but decreased overall because of avoidance of damaged from floods.

Socio-cultural impacts

food security/ self-sufficiency	reduced					✓		improved	**Comment:** Increased food security through flood-protected homestead garden and tree plantation.
health situation	worsened					✓		improved	**Comment:** Higher attendance of health workers because the cluster village offers suitable group meeting rooms and accommodation. Cluster villages are constructed in the vicinity of the community clinic. Better hygiene through WASH facilities.
cultural opportunities (e.g. spiritual, aesthetic, others)	reduced					✓		improved	**Comment:** The cluster village is a suitable meeting point for the entire community, for social gatherings or festivals.
recreational opportunities	reduced						✓	improved	**Comment:** Cluster villages offer common space for children and other land users for joint recreational activities.
situation of socially and economically disadvantaged groups (gender, age, status, ethnicity etc.)	worsened						✓	improved	**Comment:** Much improved situation for persons with disabilities who are land users. All persons with disabilities in the wider community use the cluster village as a safe space during floods. Improved situation for all land users who are from marginalised parts of society (daily labourers and share croppers).

Ecological impacts

soil loss	increased					✓		decreased	**Comment:** Increased availability of flood-protected land for vegetable gardening.

flood impacts	increased	☐☐☐☐☐✓☐	decreased	**Comment:** Raised land as safe space above flood level.
drought impacts	increased	☐☐☐☐✓☐☐	decreased	**Comment:** Drought impact in summer season decreased because of irrigation.

Off-site impacts

available shelter and safe space	decreased	☐☐☐☐☐✓☐	increased	**Comment:** Cluster villages provides additional safe space/ shelter for the wider community.

Benefits compared with establishment costs

Short-term returns	very negative	☐☐☐☐☐✓☐	very positive
Long-term returns	very negative	☐☐☐☐☐☐✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	☐☐☐☐✓☐☐	very positive
Long-term returns	very negative	☐☐☐☐☐☐✓	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

Climate-related extremes (disasters)

droughts	not well at all	☐☐☐✓☐	very well
general (river) flood	not well at all	☐☐☐☐✓	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☐ 1-10%
- ✓ 10-50%
- ☐ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ✓ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ☐ 90-100%

Number of households and/ or area covered

10 households are part of the cluster village. The approach is new in the area and has not been replicated.

Has the Technology been modified recently to adapt to changing conditions?

- ✓ Yes
- ☐ No

To which changing conditions?

- ☐ climatic change/ extremes
- ✓ changing markets
- ☐ labour availability (e.g. due to migration)

Comment: People in cluster villages are selling vegetables and fruits in the local market and some of them are carrying the fruits to distant markets. They are becoming more interested in planting further fruit trees in the cluster village. If it continues like this there could be a fruit and vegetable market in the cluster village. At the same time people started selling cow milk in the local market and its demand is increasing day to day.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- There is ownership by the land users. It's a community driven initiative & disability-inclusive in all respect. They are happy to give shelter to other villagers during flood season. There was an opportunity to create a model village in this area.

Key resource person's view

- It's an innovative programme. People's participation and their contribution is the main asset. Universal accessibility of the cluster village during floods. This pilot programme can be replicated to other riverine areas in Bangladesh.
- The accessibility measures do not only benefit persons with disabilities but are based on universal design principles to provide access and usability for everyone, including older persons, children or pregnant women. The cluster village illustrates that an accessible and safe settlement in a highly flood prone area is possible.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- The intensity of floods is difficult to predict. With average flood levels rising, land users still have to live with the risk of flood levels going above the level of their raised land. → *More research on changing weather/ climatic patterns and scientific measurement of expected flood levels.*

Key resource person's view

- The full replication of the technology depends on external funding. → *Develop a low cost version of the technology, without deep bore hole water source, concrete entrance ramp and solar system and with low-cost sanitation facilities.*

REFERENCES

Compiler: Subir Saha - sahasubirkumar67@gmail.com
Resource persons: Subir Saha – SLM specialist
Full description in the WOCAT database: hhttps://qcat.wocat.net/en/wocat/technologies/view/technologies_2005/
Linked SLM data: SLM Approach: Disability-inclusive Disaster Risk Reduction https://qcat.wocat.net/en/wocat/approaches/view/approaches_2001/
Documentation was facilitated by: Christoffel Blindenmission (CBM) - Switzerland

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		✓			
Convective storm					
Extreme Temperature					
Tropical cyclone					
Drought					
Biological hazards					
Epidemics (Humans)					
Pest (vegetation)					
Insect infestation					

Vulnerability – capacity profile of the site before the Approach was applied

Exposure								**Comment:**
of people	very high/ strong	✓					very low/ non-existent	
of private assets	very high/ strong	✓					very low/ non-existent	
of community land	very high/ strong		✓				very low/ non-existent	
of community infrastructure	very high/ strong	✓					very low/ non-existent	
Economic factors								
Access to markets	very high/ strong			✓			very low/ non-existent	
Income	very high/ strong		✓				very low/ non-existent	
Diversification of income	very high/ strong		✓				very low/ non-existent	
Savings/stocks	very high/ strong		✓				very low/ non-existent	
Bank savings/remittances	very high/ strong	✓					very low/ non-existent	
Degree insurance coverage	very high/ strong	✓					very low/ non-existent	
Social factors								
Literacy rate	very high/ strong	✓					very low/ non-existent	
Government support	very high/ strong	✓					very low/ non-existent	
Family support	very high/ strong			✓			very low/ non-existent	
Community support	very high/ strong		✓				very low/ non-existent	
Access to public services	very high/ strong	✓					very low/ non-existent	
Physical factors								
Robustness of houses	very high/ strong	✓					very low/ non-existent	*Material of construction for houses: adobe*
Robustness of infrastructure	very high/ strong	✓					very low/ non-existent	*Building material for the infrastructure: brick*

Damage and losses situation at the Approach location

Change in losses in the last 10 years

substantial increase in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☐ 0
☐ 1	☐ 1
☐ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☑ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☐ > 500	☐ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☑ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☑ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10'000 USD	☐ 5001-10'000 USD
☑ 10'001-50'000 USD	☐ 10'001-50'000 USD
☐ 50'000-250'000 USD	☐ 50'000-250'000 USD
☐ > 250'000 USD	☐ > 250'000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☑ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Approach

Local Emergency Committees (CODELs) are trained and empowered to take on responsibilities in preparing for natural disasters, which affect communities with frequent recurrences and less frequent events of greater intensity.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased	☐☐☐☐☐☐☑	increased
Evacuation and shelter	decreased	☐☐☐☐☐☐☑	increased
Safety of esp. vulnerable	decreased	☐☐☐☐☐☐☑	increased
Early warning	decreased	☐☐☐☐☐☑☐	increased
Safety of key documents	decreased	☐☐☐☐☐☐☑	increased

Economic goods (on-site)

safety of individual housing	decreased	☐☐☐☐☐☐☑	increased
safety of water stocks	decreased	☐☐☐☐☐☐☑	increased
Safety of seed/animal stocks	decreased	☐☐☐☐☐☐☑	increased
safety of land assets	decreased	☐☐☐☐☐☐☑	increased
Safety of communal assets	decreased	☐☐☐☐☐☐☑	increased

Off-site impacts

None



Members of self-help groups for persons with disabilities participating in a community planning session (Shahidul Islam, CDD).

Disability-inclusive Disaster Risk Reduction (Bangladesh)

Protibonhita Bandhob Durjog Jhuki Rash

DESCRIPTION

The disability-inclusive approach is centred around the meaningful contribution and leadership of persons with disabilities during an entire project management cycle, from the planning stage to the evaluation of impact. It contributes to empowering them to overcome social exclusion, and recognises their needs and priorities as persons who are disproportionately at risk of disaster.

The main characteristic and central feature of the approach is that persons with disabilities can actively and meaningfully participate in, contribute to, and benefit from Sustainable Land Management/ Disaster Risk Reduction activities. The approach can be applied to the implementation of any SLM or DRR activity or project. It is here illustrated based on the example of the introduction of an SLM technology in Bangladesh: The disability-inclusive, flood resilient cluster village. To ensure the disability-inclusive approach, implementing organisations must invest sufficient time and the implementing organisation needs to invest adequate time and financial resources into the formation and strengthening of self-representation groups of persons with disabilities. It then needs to support their active engagement with the local government and the wider community to address the physical and attitudinal barriers that hinder their full participation in the project and society in general. The aim is twofold: on the one hand, the participation of persons with disabilities ensures that their needs and priorities are fully taken into account in the project design and implementation, to ensure that they can benefit equally from it. On the other hand, it contributes to reducing barriers beyond the project, and empowers them to demand their rights in other areas of human development, like education, health and livelihoods. The main stages of disability inclusion are: 1) formation of self-help groups for persons with disabilities, 2) training and other capacity development activities for the groups, including rights awareness sessions and organisational management training, 3) setting up collaboration between the groups and the local government and with other members of the community, 4) participation of persons with disabilities/ group members in the planning phase to decide on the technology and adapt it to universal design standards, which take into account their needs and the needs of other groups with other specific accessibility requirements, like the elderly or pregnant women, 5) persons with disabilities (together with other land users) support the introduction of the technology (including construction activities) by providing manual labour and supervision functions, 6) full handover of the technology to land users, ensuring joint ownership that includes persons with disabilities, and provision of training for self-maintenance, 7) participation of persons with disabilities in the evaluation of the impact of the technology, sharing of lessons and good practices and continuous advocacy for community development and for the rights of persons with disabilities. Experience from Bangladesh shows that what the land users, including persons with disabilities, like about the approach is (i) the strong community engagement, (ii) the empowerment and increased status of persons with disabilities, (iii) the collaboration between persons with disabilities and persons without disability, and (iv) the adaptation of existing technology to fit their needs.

LOCATION



Location: Horipur Union, Sundargonj Sub district, Gaibandha District, Bangladesh

Geo-reference of selected sites

- 89.63049, 25.51988

Initiation date: 2015

Year of termination: 2016

Type of Approach

- traditional/ indigenous
- recent local initiative/ innovative
- ✓ project/ programme based

cbm
christoffel blindenmission
gemeinsam mehr erreichen



Persons with disabilities participate in a community consultation meeting (Md. Shahidul Islam, CDD).



A women with a disability using an accessible hand pump, which was installed following the standards of universal design (Shahidul Islam, CDD).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

To empower persons with disabilities to meaningfully participate in, contribute to and benefit from SLM and DRR activities.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **availability/ access to financial resources and services:** The financial resources for the implementation of the technology (in this case the cluster village), and the extra resources needed to ensure disability inclusion, were readily available because the technology was widely and positively recognised by the community and by donors.
- **institutional setting:** The institutional environment was overwhelmingly supportive of the implementation of the project. The local Union Council government, schools, mosques and other civil society organisations were in favour of the technology and approach, and supported its implementation.
- **collaboration/ coordination of actors:** Beneficiaries/ land users were selected through a participatory process, involving the whole community. The process was transparent and inclusive. It was a foundation for the smooth collaboration with beneficiaries and other stakeholders later on.
- **legal framework (land tenure, land and water use rights):** To ensure joint ownership by beneficiaries of the land on which the SLM/ DRR Technology was implemented, an exchange of land was needed. Due to the remoteness and scarce population of the implementation area in rural Bangladesh, a cooperative local government and a manageable legal framework, this was easy to achieve.
- **a deep-rooted tube well was installed for water access of the land users.** Water use rights were also easy to acquire.
- **policies:** No specific policies existed, which significantly affected the implementation of the technology.
- **land governance (decision-making, implementation and enforcement):** Land ownership was recognised by the local government and land governance was controlled by land owners.
- **knowledge about SLM, access to technical support:** Indigenous knowledge about SLM was enabling for the implementation of the technology. Technical expertise by the implementing organisation (Christoffel Blindemission CBM and Center for Disability in Development CDD) was available.
- **markets (to purchase inputs, sell products) and prices:** Inputs for construction and planting were locally available at reasonable prices.
- **workload, availability of manpower:** During the flood season, labour was abundant in the area, but it was scarce during the planting season. The workload for the implementation of the technology was manageable and could easily be provided by land users themselves.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The social stigma and exclusion, that persons with disabilities experience in rural Bangladesh, was a challenge for the project. Persons with disabilities are sometimes believed to be incapable of contributing anything meaningful to society and village life. Some community members did not want to associate with persons with disabilities. This required an extra effort to ensure the participation of the wider community in the project, and it required sustained advocacy and awareness-raising for the rights and dignity of persons with disabilities.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (The land users include 10 families who jointly own and inhabit the land of the cluster village):** Land users were closely engaged in the implementation of the technology by participating in decision-making processes, informing the design of the technology and contributing to the construction process.
- **community-based organisations (self-help groups of persons with disabilities are informal community based groups of 15 persons with different types of disabilities, whether physical-, sensory- and/ or mental):** The group is closely engaged in the implementation of the technology. It participates in decision-making processes, informs the design of the technology, contributes to the construction process, is engaged in the evaluation of the technology and the sharing of lessons learned to the wider community. The group also provides benefits for its members by supporting them with everyday challenges, which can be of economic, legal or social nature, and promotes the rights of all persons with disabilities in the community.
- **NGO (The implementing NGOs included an international and a local organisation in partnership (CBM and CDD):** CDD was responsible for the overall management of project implementation and the collaboration with other involved local stakeholders. CBM provided training and technical support.
- **local government (The Union Parishad government is the lowest level of local government):** The Union Parishad government managed land ownership and approved construction projects.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation			✓		
monitoring/ evaluation				✓	

Specify who was involved and describe activities

Land users contributed to the initial situation analysis and joined self-help groups for persons with disabilities.

Land users, and in particular those who are persons with disabilities, participated in all planning and decision-making processes related to the design and introduction of the technology, including the selection of the land.

Land users engaged in the construction of the technology by providing paid and unpaid labour.

The land users monitored the implementation process and gave feedback to the implementing NGOs when changes were needed. Land users participated in the evaluation of the technology and the approach and contributed to the dissemination of good practices and learnings.

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- personal experience and opinions (undocumented)

Comment: The cluster village technology was known to the community before the implementation. The technology was suggested by the implementing NGOs to the community, which supported its implementation. The technology was adapted to fit the users with technical support of the implementing NGOs.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- Research

Capacity building/ training

Training was provided to the following stakeholders

- ✓ land users
- ✓ field staff/ advisers

Form of training

- ✓ on-the-job
- farmer-to-farmer
- ✓ demonstration areas
- public meetings
- ✓ courses

Subjects covered

On the job training and demonstration on the construction and maintenance of the technology. Training to self-help groups for persons with disabilities on the rights of persons with disabilities, the use and benefits of the technology for persons with disabilities and the management of self-help groups.

Advisory service

Advisory service was provided

- [x] on land users' fields
- [ ] at permanent centres

Comment: The implementing NGOs provided detailed technical support to land users on the adaptation of the technology to the needs of persons with disabilities, following the standards of universal design.

Institution strengthening

Institutions have been strengthened/ established

- [ ] no
- [ ] yes, a little
- [x] yes, moderately
- [ ] yes, greatly

at the following level

- [x] local
- [ ] regional
- [ ] national

Type of support

- [x] financial
- [x] capacity building/ training
- [x] equipment

Describe institution, roles and responsibilities, members, etc.

Local self-help groups and their umbrella organisation (called the "APEX body") at Union level were strengthened. The roles of the self-help groups were to establish a mutual support network, raise awareness among group members of disability rights and development issues, pool resources and give individual persons with disabilities a greater political voice. The APEX body gave the groups contact points beyond their immediate community and gave further weight to their political voice.

Further details

To strengthen self-help groups, they were provided with, 1) awareness and skill development trainings, 2) financial support for climate resilient income generation through agricultural and non-agricultural activities, and 3) assistance devices.

Monitoring and evaluation

A participatory monitoring and evaluation system was implemented with support of the self-help groups for persons with disabilities.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [ ] 2000-10000
- [ ] 10000-100000
- [x] 100000-1000000
- [ ] > 1000000

Precise annual budget: 218702

Major donor: The annual budget includes the total funds used for the introduction of the technology. Funds were provided through the implementing NGOs CBM and CDD, with the support of a donor from Germany.

The following services or incentives have been provided to land users

- [x] Financial/ material support provided to land users
- [x] Subsidies for specific inputs
- [ ] Credit
- [ ] Other incentives or instruments

Financial/ material support provided to land users

Land users received a daily fee for the labour provided for the introduction of the technology. The NGOs also provided most material input for the technology, including soil, sand, seeds, seedlings, grass, trees, the ramp, water and sanitation facilities.

Subsidies for specific inputs (including labour)

Labour by land users was

- [ ] voluntary
- [ ] food-for-work
- [x] paid in cash
- [ ] rewarded with other material support

	partly financed	fully financed
labour *Labour provided by land users for certain construction activities was compensated with a daily fee.*		✓
equipment: machinery *Rent of sand extraction machine was funded by the project.*		✓
equipment: tools *Tools for construction activities were provided to land users by the project.*		✓
agricultural: seeds *Seeds and seedlings for the homestead garden were provided by the project.*		✓
agricultural: fertilizers *The facility for composting organic fertilizer was provided by the project.*	✓	
construction: wood *Wood for fencing for the homestead vegetable garden in front of all houses and a flood resilient cow shed in the village was provided by the project.*	✓	
infrastructure: roads *Construction material for barrier-free connections to all houses in the village was funded by the project.*	✓	

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *The approach is based on the empowerment of land users, in particularly those who are persons with disabilites. It ensured participation of persons with disabilities who would otherwise be isolated and excluded.*				✓
Did the Approach enable evidence-based decision-making? *Post-implementation evaluation shows reduced stigmatisation of persons with disabilities in the local communities. The lessons drawn from the documentation of the project implementation enabled improvement in the disability inclusive approach.*		✓		
Did the Approach help land users to implement and maintain SLM Technologies? *The project supported land users with the implementation and use of the technology.*				✓
Did the Approach improve coordination and cost-effective implementation of SLM? *The coordination among land users has improved and actions of land management have become more cost effective.*			✓	
Did the Approach mobilise/ improve access to financial resources for SLM implementation?	✓			
Did the Approach improve knowledge and capacities of land users to implement SLM? *Land users were provided with training and demonstrations about the implementation and use of the technology.*			✓	
Did the Approach improve knowledge and capacities of other stakeholders? *The local government, other members of the community and other non-governmental organisations took note of the technology and sensitisation about the rights and needs of persons with disabilities increased.*			✓	
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *The approach strengthened the collaboration between the local government and self-help groups of persons with disabilities.*			✓	
Did the Approach mitigate conflicts? *Joint decision-making and the resolution of conflicts among land users improved through the joint management of the land.*				✓
Did the Approach empower socially and economically disadvantaged groups? *The approach empowered persons with disabilities and other land users, who all belonged to economically marginalised groups. Their social and economic status greatly improved.*				✓
Did the Approach improve gender equality and empower women and girls? *Land user participation in the implementation of the technology always included men and women. Self-help groups for persons with disabilities, which were formed and strengthened by the project, always included around 50% women. Meaningful participation by women in group meetings was promoted by the implementing NGOs.*			✓	
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *The technology was of great interest for youth clubs, high school students and other young people in the community and many voiced their intention of replicating it in the future.*				✓
Did the Approach improve issues of land tenure/ user rights that hindered implementation of SLM Technologies?	✓			
Did the Approach lead to improved food security/ improved nutrition? *The technology improved food security and nutrition through the introduction of a fruit tree plantation and a homestead vegetable garden.*			✓	
Did the Approach improve access to markets? *The construction of a ramp for road access allows wheelchair users and other persons with limited mobility to better access local markets.*		✓		
Did the Approach lead to improved access to water and sanitation? *The technology improved water access through the drilling of a deep bore hole water source for common water access and the construction of barrier free household latrines.*				✓
Did the Approach lead to more sustainable use/ sources of energy? *The technology led to more sustainable energy use through the provision of household based mini solar systems.*			✓	
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? *The technology offers a safe and accessible space for housing, fruit and vegetable cultivation and livestock shelter. It greatly improved the capacity of land users to adapt to the increasing occurrence and intensity of monsoon floods.*				✓
Did the Approach lead to employment, income opportunities? *The technology improved income opportunities through the introduction of a flood resilient fruit tree plantation and homestead vegetable garden. Part of the harvest can be sold on the market.*			✓	

Main motivation of land users to implement SLM

- [x] increased production
- [ ] increased profit(ability), improved cost-benefit-ratio
- [x] reduced land degradation
- [x] reduced risk of disasters
- [x] reduced workload
- [ ] payments/ subsidies
- [ ] rules and regulations (fines)/ enforcement
- [ ] prestige, social pressure/ social cohesion
- [x] affiliation to movement/ project/ group/ networks
- [ ] environmental consciousness
- [ ] customs and beliefs, morals
- [ ] enhanced SLM knowledge and skills
- [ ] aesthetic improvement
- [ ] conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- [ ] no
- [ ] yes
- [x] uncertain

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Land users greatly appreciate the empowerment and social cohesion that the approach enabled. Decisions are taken together and conflicts in the village can be mitigated. The cluster village has become a safe space and meeting point for the whole community.
- The cluster village is fully inclusive of persons with disabilities (inclusion in decision-making processes and social activities and fully accessible infrastructure), which is something that land users are proud of because it is the first such set-up in the community and is appreciated as a model by others.

Key resource person's view

- Meaningful participation and of persons with disabilities in project implementation has a signaling effect beyond the project and fosters sensitization of the local government and wider community for more inclusive community development and principles of universal design.
- Formation of self-help groups of persons with disabilities and their active engagement with the wider community around community development issues, which go beyond the rights and needs of persons with disabilities, led to empowerment and greater social inclusion of persons with disabilities.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Technical knowledge gap when it comes to the maintenance of the technology and the continuous dependence on external support. → *Invest sufficient resources in training and capacity building and emphasis and formalise the transfer of ownership of the technology to land users.*

Key resource person's view

- Formation and strengthening of self-help groups of persons with disabilities to the level where they are sustainable and able to make significant contributions to the projects and significant resources with regard to time and funds invested. → *Strong commitment of the implementing organisation to inclusive programming and sufficient internal capacity building.*

REFERENCES

Compiler: Subir Saha - sahasubirkumar67@gmail.com

Resource persons: Subir Saha (sahasubirkumar67@gmail.com) - DRR specialist; Shahidul Islam (shahidulpls@yahoo.com) - DRR specialist; Ashutosh Dey (ashutosh.dey@cbm.org) - DRR specialist; Manuel Rothe (manuel.rothe@cbmswiss.ch) - DRR Specialist

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_2001

Linked SLM data: SLM Technology: Disability-inclusive, flood resilient cluster village https://qcat.wocat.net/en/wocat/technologies/view/ technologies_2005/

Documentation was facilitated by: Christoffel Blindenmission (CBM) - Switzerland

Key references

Disability-inclusive disaster risk management, CBM, 2013: http://www.cbm.org/article/downloads/54741/Disability_Inclusive_Disaster_Risk_Management.pdf

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		☑			
Convective storm					
Extreme Temperature					
Tropical cyclone					
Drought					
Biological hazards					
Epidemics (Humans)					
Pest (vegetation)					
Insect infestation					

Vulnerability – capacity profile of the site before the Approach was applied

Exposure								**Comment:**
of people	very high/ strong	☑					very low/ non-existent	
of private assets	very high/ strong	☑					very low/ non-existent	
of community land	very high/ strong		☑				very low/ non-existent	
of community infrastructure	very high/ strong	☑					very low/ non-existent	
Economic factors								
Access to markets	very high/ strong			☑			very low/ non-existent	
Income	very high/ strong		☑				very low/ non-existent	
Diversification of income	very high/ strong		☑				very low/ non-existent	
Savings/stocks	very high/ strong		☑				very low/ non-existent	
Bank savings/remittances	very high/ strong	☑					very low/ non-existent	
Degree insurance coverage	very high/ strong	☑					very low/ non-existent	
Social factors								
Literacy rate	very high/ strong	☑					very low/ non-existent	
Government support	very high/ strong	☑					very low/ non-existent	
Family support	very high/ strong			☑			very low/ non-existent	
Community support	very high/ strong		☑				very low/ non-existent	
Access to public services	very high/ strong	☑					very low/ non-existent	
Physical factors								
Robustness of houses	very high/ strong	☑					very low/ non-existent	*Material of construction for houses: adobe*
Robustness of infrastructure	very high/ strong	☑					very low/ non-existent	*Building material for the infrastructure: brick*

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☑ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☐ 0
☐ 1	☐ 1
☐ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☑ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☐ > 500	☐ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☑ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☑ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10'000 USD	☐ 5001-10'000 USD
☑ 10'001-50'000 USD	☐ 10'001-50'000 USD
☐ 50'000-250'000 USD	☐ 50'000-250'000 USD
☐ > 250'000 USD	☐ > 250'000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☑ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Approach

Local Emergency Committees (CODELs) are trained and empowered to take on responsibilities in preparing for natural disasters, which affect communities with frequent recurrences and less frequent events of greater intensity.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased	☑ increased
Evacuation and shelter	decreased	☑ increased
Safety of esp. vulnerable	decreased	☑ increased
Early warning	decreased	☑ increased
Safety of key documents	decreased	☑ increased

Economic goods (on-site)

safety of individual housing	decreased	☑ increased
safety of water stocks	decreased	☑ increased
Safety of seed/animal stocks	decreased	☑ increased
safety of land assets	decreased	☑ increased
Safety of communal assets	decreased	☑ increased

Off-site impacts

None



Local actors during a joint inspection of a water-gallery under construction (HELVETAS Swiss Intercooperation Pakistan).

Sub-surface water harvesting for more efficient use of water resources (Pakistan)

Infiltration gallery

DESCRIPTION

The purpose of this water harvesting technology is to capture, collect and distribute sub-surface water. First, an infiltration gallery is developed, which allows the percolation and collection of sub-surface water through perforated pipes at a depth of approximately 3-4.5 metres. Sub-surface water is filtered by gravel/ sand underground and infiltrates into the gallery. The harvested water is used for household needs as well as for livestock and irrigation through gravity flow.

This method is applied in areas with low rainfall, where soils have a sandy-gravelly texture and where the sub-surface water can not percolate deeply, but instead flows laterally in shallow sub-surface channels. The technology consists of the following main elements: filtration materials (sand/ gravel), collection chambers, perforated pipes, conveyance lines made from solid blocks, and storage tanks. Construction includes the following main activities and inputs:

- Excavation of rectangular trenches with machinery or by hand.
- Construction of a solid base line with PCC (plain cement concrete) blocks on the top of boulders.
- Installation of perforated and blind pipes and storage tanks where necessary.
- Coverage of the trench first with boulders and then sand on top.

Once the gallery is constructed there is no further need for intervention; this means that maintenance costs for the user (farmer, households of the local community) are minimal. Traditionally, the technology has been implemented by local farmers for many years. Where improvements are required, support by local technicians is provided. The technology is based on local knowledge, and locally available construction materials. The method is technically simple, cost-effective and environmentally friendly. Farmers and other users consider this technology as very efficient as there is no need for external energy supply, and it can be easily replicated. Furthermore, it requires a minimum of external construction material, and the operation costs are minimal. The captured water is filtered through the subsurface layers and - as long as there is no specific external contamination - it is safe and can be used for various purposes as already noted. This extra water supply is particularly effective for irrigation, contributing to increased production and allowing diversification of crop production (potentially also of high value crops), thereby improving the livelihoods of remote rural communities. The primary impact of this technology is to reduce risks related to droughts or water scarcity as natural phenomena or consequences of climate change effects. Additionally infiltration of water into the galleries reduces surface erosion of fertile soil, hence it lessens soil degradation.

LOCATION



Location: Karak, Laki Marwat & Dera Ismail Khan, Southern Khyber Pakhtunkhwa, Pakistan

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites

- 70.78244, 32.37292

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: 2016

Type of introduction

- through land users' innovation
- ✓ as part of a traditional system (> 50 years)
- during experiments/ research
- through projects/ external interventions

HELVETAS Swiss Intercooperation



Construction of an infiltration gallery (HELVETAS Swiss Intercooperation Pakistan).



Collection chamber: infiltration gallery system (HELVETAS Swiss Intercooperation Pakistan).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- ✓ protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Cropland - Annual cropping
Main crops (cash and food crops): - Wheat, maize/ corn, millet - Tomato and other vegetables - Fruit trees: guava etc.

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology: Prior to the establishment of infiltration galleries, cropland was mainly rainfed and only a single crop was produced per year. The cropping efficiency increased up to 150% (growing three crops in a year instead of just one). As a result of the introduced technology, farmers can now produce a wider range of crops and have increased their cropping efficiency.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- ✓ adapt to land degradation
- not applicable

Livestock density: n.a.
Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion

Comment: Furthermore the technology contributes to reducing risks and losses linked to natural droughts and/ or the effect of climate change.

SLM group

- water harvesting
- irrigation management (incl. water supply, drainage)
- groundwater management

SLM measures



structural measures - S3: Graded ditches, channels, waterways, S7: Water harvesting/ supply/ irrigation equipment, S10: Energy saving measures

TECHNICAL DRAWING

Technical specifications

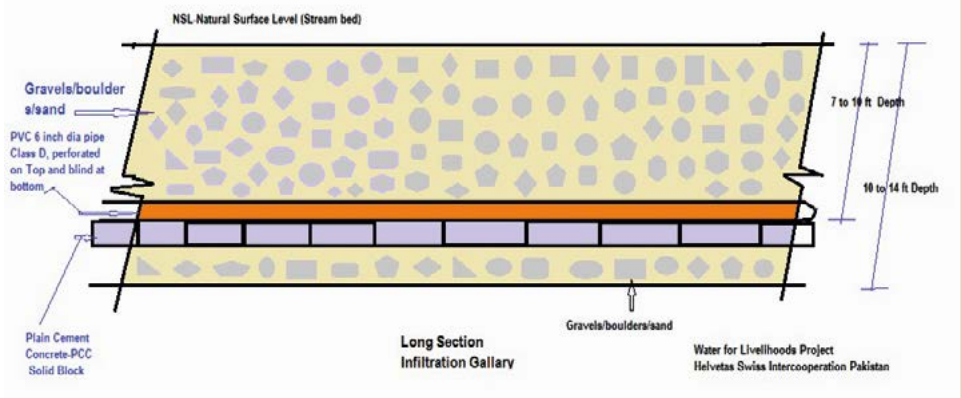


Figure: Munawar Khan & Khan Muhammad

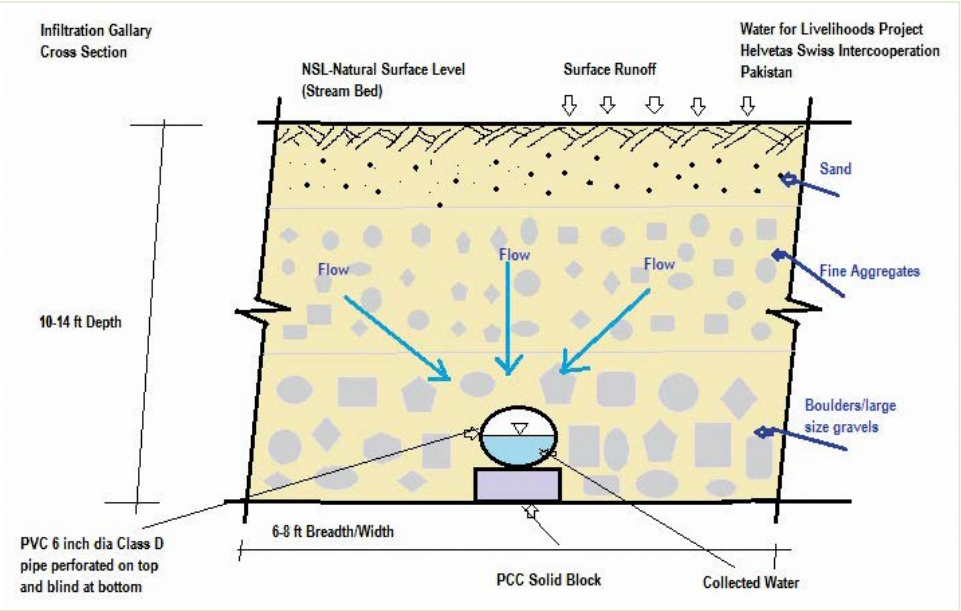


Figure: Munawar Khan & Khan Muhammad

Dimensions of the cross section:
– Depth: 10 to 15 feet (approx 3-4.5 metres), width: 6 to 8 feet (approx 2-2.5 metres), length: 300 to 1000 feet (approx 100-300 metres)
– Slope: 3% over a length of 200 feet (approx 60 metres)
– Volume of storage tank: 30 x 30 x 4 feet

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **Infiltration gallery** volume, length: **600 feet (approx 180 metres) gallery including 3600 feet (approx 1100 metres) conveyance line to the tank/ water user's end point.**
- Currency used for cost calculation: **US Dollars**
- Average wage cost of hired labour per day: Skilled labour: 12 USD/ day, unskilled labour: 6 USD/ day.

Most important factors affecting the costs

– Length of the infiltration gallery
– Length of the conveyance line
– Size of storage tank (not always included)

Establishment activities

1. Excavation (Structural; 2 weeks)
2. Dry stone packing (Structural)
3. Laying of PCC block (plain cement concrete) (Structural)
4. Installation & fixing of perforated pipes 6" (15 cm) diametre (Structural)
5. Establishment of filtration media (boulder, gravel, sand packing) (Structural)
6. Construction of water collecting chamber at gallery's end point/ water users access point (concrtete) (Structural)
7. Conveyance line 3" (7.5 cm) diametre (Structural)
8. Construction of storage tank (if required) (Structural)

Comment: In total, it takes 3 months to complete the construction of the infiltration gallery unit of 600 feet (180 metres) including the conveyance line and storage tank. Some of the activities can be carried out simultaneously.

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Skilled Labour	Days	109.0	12	1308	0
Unskilled Labour	Days	465.0	6	2790	100
Equipment					
Machinery (Excavator)	Hour	118.0	25	2950	0
Construction material					
Bricks (Number)	1000	12.5	95	1187	0
PCC blocks, rough stone (cubic foot)	100t	44.5	50	2225	0
Cement (50 kg bags)	50	275.0	5	1375	0
sand, crush, boulder, gravel (cubic foot)	100	63.0	35	2205	0
Other					
PVC pipe perforated (6" diametre filter section class D) (ft)	1	590.0	5	2950	0
PVC blind pipe (3" diametre class B) (ft)	1	3600.0	1	3600	0
Total costs for establishment of the Technology				**20590.5 USD**	

Maintenance activities

This technology is based on a single cost/ one-off investment. Apart from minor repairs of storage tank, there are no significant maintenance costs. The filter function of the boulder layer and the perforated pipes reduce sedimentation problems. Small amounts of silt and fine sediments in the storage tank can be removed with minor effort by the user (unskilled labour; no tools required).

NATURAL ENVIRONMENT

Average annual rainfall

- [ ] < 250 mm
- [x] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone

- [ ] humid
- [ ] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate

Average annual rainfall in mm: 300
Rains in both seasons (monsoon & winter)
Name of the meteorological station: Kohat & Bannu & DIKhan
Met Department Automatic Weather Station
Min./ max. temperatures: 9°C/ 42°C

Slope

- [ ] flat (0-2%)
- [x] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform

- [ ] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [x] valley floors

Altitude

- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [x] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in

- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth

- [ ] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)

- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)

- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content

- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table

- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water

- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)

- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?

- [ ] yes
- [x] no

Occurrence of flooding

- [x] yes
- [ ] no

Species diversity

- [ ] high
- [x] medium
- [ ] low

Habitat diversity

- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [ ] 10-50% of all income
- [x] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [x] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [ ] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor	✓					good
education	poor		✓				good
technical assistance	poor	✓					good
employment (e.g. off-farm)	poor	✓					good
markets	poor		✓				good
energy	poor	✓					good
roads and transport	poor		✓				good
drinking water and sanitation	poor	✓					good
financial services	poor	✓					good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production	decreased						✓		increased
crop quality	decreased					✓			increased
fodder production	decreased					✓			increased
product diversity	decreased						✓		increased
production area (new land under cultivation/ use)	decreased					✓			increased
drinking water availability	decreased						✓		increased
drinking water quality	decreased						✓		increased
water availability for livestock	decreased					✓			increased
irrigation water quality	decreased							✓	increased
demand for irrigation water	decreased						✓		increased
farm income	decreased						✓		increased
diversity of income sources	decreased					✓			increased

Comment: Increased crop production efficiency due to additional year-round water for irrigation.

Comment: With the additional water for irrigation, water is not a limiting factor anymore, which allows improved crop production in terms of quality and quantity.

Before SLM: -1
After SLM: 1

Before SLM: -1
After SLM: 2
Comment: With additional water through irrigation, additional crops might be cultivated, which contribution to production and income diversification.

Comment: With additional water through irrigation, additional areas can be used for agriculture.

Before SLM: 0
After SLM: 2

Before SLM: 0
After SLM: 3

Comment: The technology directly contributes to additional water for irrigation.

Comment: Irrigation allows improved, diversified crop production. Water access for livestock ensures animal health. Both are crucial for the income of local farmers.

Before SLM: 0
After SLM: 1

Socio-cultural impacts

food security/ self-sufficiency	reduced		improved	**Before SLM:** -1 **After SLM:** 2
land use/ water rights	worsened		improved	**Before SLM:** 0 **After SLM:** 2

Ecological impacts

harvesting/ collection of water (runoff, dew, snow, etc.)	reduced		improved	**Before SLM:** 0 **After SLM:** 2
vegetation cover	decreased		increased	**Before SLM:** 0 **After SLM:** 1
drought impacts	increased		decreased	**Comment:** Reduced consequenes of droughts/ water scarcity, in terms of production failure/ lost harvest and reduced production.

Off-site impacts

water availability (groundwater, springs)	decreased		increased
reliable and stable stream flows in dry season (incl. low flows)	reduced		increased

Benefits compared with establishment costs

Short-term returns	very negative		very positive
Long-term returns	very negative		very positive

Benefits compared with maintenance costs

Short-term returns	very negative		very positive
Long-term returns	very negative		very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

annual rainfall decrease	not well at all		very well	
seasonal rainfall increase	not well at all		very well	Season: summer

Climate-related extremes (disasters)

drought	not well at all		very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- ✓ 1-10%
- 10-50%
- more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- 0-10%
- ✓ 10-50%
- 50-90%
- 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- ✓ Yes
- No

Comment: Design of infiltration galleries (diametre of pipes, size of perforation, slope etc.) was adjusted to local conditions taking into account local rainfall/ amount of water.

To which changing conditions?

- ✓ climatic change/ extremes
- changing markets
- labour availability (e.g. due to migration)

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Low cost measure, which requires only a one-time investment, low/ no repair or maintenance costs are required.
- Well accepted and replicated by local farmers in the area since it is a simple and traditional technology.
- No requirement for external energy (no pumping). Allows harvest of sub-surface water for various purposes (domestic use, irrigation, livestock).
- Environmentally friendly, making use as much as possible of local construction materials (e.g. gravel, sand).

Key resource person's view

- The technology can be replicated in areas with a similar conditions.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- If the land, where the sub-surface water is harvested is communal property, the distribution of water rights may be an issue. → *Involvement of farmers' organisations, distribution of water rights based on land-holdings.*

Key resource person's view

- Filtration media might clog in the long run if the silt content is high. → *Filtration should be prepared from a mix of graded materials (sand, gravel, boulder).*
- Considering the initial investment cost, the measure cannot be done by an individual alone. → *It requires an organised (group within) community. Though this pre-condition can also be interpreted as a strength for coordinated and efficient use of water.*

REFERENCES

Compiler: Khan Muhammad - khanm@helvetas.org.pk
Resource persons: Khan Muhammad (khanm@helvetas.org.pk) - Engineer-Water conservation Nasib-ur Rehman - Water Management specilist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_540/
Linked SLM data: Technology: Water Use Management Plan (WUMP) https://qcat.wocat.net/en/wocat/approaches/view/approaches_747/
Documentation was facilitated by: Institution: HELVETAS Swiss Intercooperation - Pakistan; Project: Good practices in DRR

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami				☑	
Flood			☑		
Extreme Temperature			☑		
Drought			☑		
Biological hazards					
None					
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

Exposure							**Comment:**
of people	very high/ strong			☑		very low/ non-existent	*Floods damage the people life damages. Floods & drought damages private assets like crops, houses and Livestock. Frequent Floods washed away agriculture land.*
of private assets	very high/ strong			☑		very low/ non-existent	
of community land	very high/ strong			☑		very low/ non-existent	
of community infrastructure	very high/ strong				☑	very low/ non-existent	*Floods partially damage roads and other public infrastructures.*
Economic factors							
Access to markets	very high/ strong				☑	very low/ non-existent	
Income	very high/ strong				☑	very low/ non-existent	*Less income as the land was rain fed.*
Diversification of income	very high/ strong					☑ very low/ non-existent	*No opportunity for diversification of crops.*
Savings/stocks	very high/ strong				☑	very low/ non-existent	
Social factors							
Literacy rate	very high/ strong			☑		very low/ non-existent	
Government support	very high/ strong					☑ very low/ non-existent	
Family support	very high/ strong			☑		very low/ non-existent	
Access to public services	very high/ strong					☑ very low/ non-existent	
Physical factors							
Robustness of houses	very high/ strong				☑	very low/ non-existent	
Robustness of infrastructure	very high/ strong				☑	very low/ non-existent	

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☑ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1	☐ 1
☑ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☑ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☑ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☐ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☑ 51-80%
☐ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10'000 USD	☐ 5001-10'000 USD
☑ 10'001-50'000 USD	☐ 10'001-50'000 USD
☐ 50'000-250'000 USD	☑ 50'000-250'000 USD
☐ > 250'000 USD	☐ > 250'000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☑ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Technology

The primary goal of the infiltration galleries is to prevent or reduce droughts/ water shortage. Hence the protection goal is the agricultural production, livestock as well as people's health (water for household consumption). The technology consists in the collection of shallow ground water across the streambed having high recharge. The detention of this collected water flow helps to ensure water availability for drinking and irrigation purposes. The underground infiltration galleries are permeable horizontal or inclined conduits into which water can infiltrate from an overlying or adjacent source. The galleries are constructed at 10-14 feet depth in an area with sufficient recharge and a good permeability of the soil to conduct the water to the existing gallery under the existing head conditions.

IMPACTS

Additional benefits of the Technology

			Comment:
Safety (on-site)			
Safety of people	decreased	increased	
Economic goods (on-site)			
Safety of individual housing	decreased	increased	
Safety of water stocks	decreased	increased	
Safety of seed/animal stocks	decreased	increased	
Safety of land assets	decreased	increased	
Off-site impacts			
Income increase	decreased	increased	*Additional water allows crop diversification and increase of crop production.*



Community members (Water User Association) mapping the water resources of their area, a key activity of the approach (Muhammad Yousuf).

Water Use Management Plan (WUMP) (Pakistan)

WUMP

DESCRIPTION

The overall purpose of a WUMP is to compile an inventory of available water resources in a particular geographical or administrative area. This is to identify communities' priorities in order to achieve effective, equitable and efficient use of water resources at the local level. This approach promotes a participatory and inclusive analysis and implementation of measures for sustainable management of water, land and related resources.

The WUMP approach has the following specific objectives:

- to assess water resources, existing uses and requirements;
- to determine water access rights and equity issues through inclusive and interactive dialogue;
- to plan and manage water resources considering multiple needs and uses in a participatory manner;
- to prioritise required measures, considering climate change and disaster risk;
- to promote coordinated water resource development for different stakeholders;
- to promote the sustainable use of water, protecting water resources and conservation of the environment;
- to strengthen local institutions;
- to include economically and socially disadvantaged groups;
- to promote an interactive dialogue for improvement of regulatory frameworks and policies in the water sector.

The method involves visits by a field team to collect information from the community, which is done through a focus group discussion, preparation of village maps, social and technical questionnaires. The WUMP process consists of four main stages: 1) preparation; 2) assessment/ analysis of information; 3) planning; 4) implementation (see flow chart with sub-steps). The process and results of a WUMP are based on a participatory process, which promotes inclusiveness. It fosters coordination and collaboration among different local stakeholders including government, communities and the private sector and helps to establish the baseline situation and a common understanding. Land users and other local actors appreciate this approach as it promotes a participatory, transparent process for equitable distribution of water and sustainable management of water related resources. The approach helps to overcome potential economic or socio-cultural barriers, by providing a common space for joint analysis, discussion and solution finding by facilitating interaction between stakeholders of different contexts.

LOCATION



Location: Dera Ismail Khan Thensil (subdivision), Khyber Pakhtunkhwa (province), Pakistan

Geo-reference of selected sites

- 70.91125, 31.84023

Initiation date: 2014

Year of termination: 2019

Type of Approach

- traditional/ indigenous
- recent local initiative/ innovative
- ✓ project/ programme based

HELVETAS Swiss Intercooperation



Important actors participating in Water Use Management Plan data collection through a focus group discussion (Muhammad Yousaf).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The main aim of the WUMP approach is to assess the availability of water resources, existing uses/ demands and future requirements/ needs. The WUMP helps to address water access, equity issues and to balance these rights through interactive dialogue within the community and other local stakeholders. The WUMP approach therefore contributes actively to water governance and improved management of natural resources.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The approach helps to overcome potential economic or socio-cultural barriers, by providing a common space for joint analysis, discussion and solution finding by facilitating interaction between stakeholders of different contexts.
- **availability/ access to financial resources and services:** The implementation of the WUMP tends to increase access to water for productive purposes with positive impacts on households/ communities' income. The results of the WUMP process with its priorities of intervention are recognised by local government and reflected in local annual development plans and resulting budgets. The WUMP defines options for other actors to invest in the water sector based on communities' priorities.
- **institutional setting:** WUMP is steered by the District Coordination Committee having representatives from all concerned government departments, Water User Association include women members, and representatives from civil society where they address key issues and take decisions regarding the local water sector.
- **collaboration/ coordination of actors:** Collaboration among actors is the central element of the WUMP, which promotes coordinated water resource development involving different stakeholders: communities and government and non-governmental organisations. The process enables local institutions to consider needs and participation of economically and socially disadvantaged groups.
- **legal framework (land tenure, land and water use rights):** WUMP addresses and defines solutions on water access & equity issues through interactive dialogue.
- **policies:** WUMP can influence sector policies at the local level based on the collection of baseline data and evidence, which contributes to improved frame conditions. Topics, priorities and challenges of the WUMP are addressed with stakeholders at the District Coordination Committee, which can actively influence policies of the water sector.
- **knowledge about SLM, access to technical support:** The local stakeholders, namely communities, are directly involved in the implementation of the WUMP, which improves their knowledge about SLM.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (rural local communities, water & land users):** Participation as an integral part in preparation at village level. Contribution to the assessment, prioritisation and implementation of the interventions.
- **community-based organisations (Water User Associations (WUA)/ Water Users Groups (WUG)):** Responsible to support and facilitate the WUMP process, social support, provision of primary information. Ensure participation and involvement of all WUA members. Coordinate with relevant authorities and other development actors to identify technical and financial support in their area/ water sector.
- **SLM specialists/ agricultural advisers (staff of the Water for Livelihoods Project:** WUMP coordinator, engineer: Coaching and guidance at all levels, steering of the WUMP process in collaboration with the District Government, organise training as scheduled, support field teams for the collection of technical and social information/ data.
- **NGO (Local partner NGO):** Project implementation, social mobilisation and interaction at field level to ensure that the social dimension, and local concerns deserving support are addressed, and that the water user associations (WUA) are inclusive and gender concerns are duly represented. Support water user associations in their advocacy efforts to mobilise resources for the WUMP.

- **private sector (consultant):** Compilation of data, collect information and drafting of WUMP.
- **local government (district authorities/ administration):** Provision of legal and administrative acceptance, recognition and support to WUMP implementation. Support through provision of timely technical services to water user association/ groups in WUMP implementation, validation of information (data regarding drinking water supply, irrigation, water use efficiency, soil conservation by Public Health Engineering Department, Irrigation Department, On-Farm Water Management Department, Soil Conservation Department). Participation to ensure participatory monitoring and provide feedback to the district government for improvements in delivery of water sector services.
- **national government (planners, decision-makers) (District and provincial governments):** Policy dialogue counterpart to address WUMP issues, which require a change in policies, coordination and engagement with in-line authorities and to allocate resources for the integration and implementation of WUMP in the district development plan (ADP).
- **international organisation (Swiss Agency for Development and Cooperation (SDC)):** Financial resources. Partner for advocacy and policy dialogue to address key topics in the water sector in their policy dialogue with national government representatives.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation				✓	
monitoring/ evaluation				✓	

Specify who was involved and describe activities:

Community through Water User Association (WUA) and Water User Group (WUG) in their activities: Support and facilitate the WUMP, ensure that all WUGs are involved in the process, link with relevant authorities and other development actors for technical and financial support development.

Community: WUA/ WUG in their activities: Participate as an integral part in the preparation of WUMP at village level. Contribute to conducting feasibility, implementation and execution of interventions.

Community: WUA/ WUG in their activities: Support a system for cost contribution by the community. Link with relevant authorities and other development actors to seek technical and financial support in their area for water sector development. Promote and advocate for sustainable development in the water sector

Community: WUA/ WUG in their activities: Ensure equitable water rights and promote good water governance principles. Ensure strong linkages with WUA/ community through regular meetings and documentation of decisions.

Flow chart

The process of WUMP is divided into 4 stages consisting of 13 steps.

4 stages and 13 planning steps of the Water Use Management Plan (WUMP) process

Process at village, village council and Tehsil level in Khyber Pakhtunkhwa Province

4. Implementation (13)	13	Implementation of WUMP and ist priority measures
	12	Endorsement by District authorities
	11	Approval by Tehsil Council
3. Planning (8-12)	10	Elaboration of draft WUMP
	9	Prioritization at Tehsil Level
	8	Prioritization at village Council Level
2. Assessment (5-7)	7	Combination of socio-economic and technical assessment report
	6	Technical assessment
	5	Socio-economic assessment
1. Preparation	4	Capacity development of village council respresentatives
	3	Orientation to village Council and representatives of WUG/WUA*
	2	Background information collection
	1	WUMP orientation to stakeholders and Tehsil selection

*Water User Groups/water User Associations

Figure: Syed Hussain Mustafa, Khan Muhammad, Tawheed Gul, Munawar Khan Khattak

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- ✓ personal experience and opinions (undocumented)

Comment: The technology is selected via mutual consensus at village council level. This process is facilitated by a SLM specialist. Women - as well as other vulnerable and marginalised groups - are also part of the Water User Association and participate in the discussion and decision making process. Where joint meetings of men & women is not possible due to cultural constraints, separate meetings of men & women are conducted to cover the voices and concerns of both.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ☑ Capacity building/ training
- ☑ Advisory service
- ☑ Institution strengthening (organisational development)
- ☑ Monitoring and evaluation
- ☐ Research

Capacity building/ training

Training was provided to the following stakeholders

- ☑ Capacity building/ training
- ☑ Advisory service

Form of training

- ☑ on-the-job
- ☑ farmer-to-farmer
- ☐ demonstration areas
- ☑ public meetings
- ☐ courses

Subjects covered

Water resources conservation, efficient use of water resources, irrigation water distribution/ scheduling.

Comment: Water Users are trained in different techniques of water conservation, such as water crop budgeting, local flow measuring techniques, irrigation scheduling with regard to specific crops.

The users are specifically trained in techniques for efficient water use, such as furrow irrigation, raised bed irrigation, mulching, etc.

Advisory service

Advisory service was provided

- ☑ on land users' fields
- ☑ at permanent centres

Comment: SLM specialists make field visits and provide technical guidance to Land Users The Land Users visit relevant organisations for technical guidance.

Institution strengthening

Institutions have been strengthened/ established

- ☐ no
- ☐ yes, a little
- ☑ yes, moderately
- ☐ yes, greatly

at the following level

- ☑ local
- ☐ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.

Water User Association (WUA, local Institutions) at district & sub-district level are strengthened. The legally recognised WUA and Apex of the WUA take gradually responsibilities to support and facilitate the WUMP process. The WUAs strive for improvements in the water sector and are a catalyst to bring together and pool communities, civil society organisations, local authorities and other actors of different sectors to address water issues and development options.

Type of support

- ☐ financial
- ☑ capacity building/ training
- ☐ equipment

Further details

The project provided training for 16 Water User Associations (WUAs) and 3 Apex WUAs in Chitral, Karak, and DI Khan. These 16 associations aim to improve development in the water sector, to improve water governance to contribute to resolutions in case of disputes amongst different water right holders for equitable access to water at local and at district level. Through these training sessions, the WUGs/ WUAs members representing various groups/ associations - including representatives from Government Line Agencies are trained in community management & skills, mediation in case of water disputes, monitoring/ documentation and health/ hygiene.

Monitoring and evaluation

The principle of the monitoring is to actively engage the communities associations (WUA/ WUG) and capture their observations and concerns. This is done through direct feedback from communities, during regular field visits and interaction with technical departments, who receive feedback from communities based on regular exchanges.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- ☐ < 2000
- ☑ 2000-10000
- ☐ 10000-100000
- ☐ 100000-1000000
- ☐ > 1000000

Precise annual budget: n.a.

Comment: The cost for the preparation of WUMP depends on the size of the area.

The following services or incentives have been provided to land users

- ☑ Financial/ material support provided to land users
- ☐ Subsidies for specific inputs
- ☐ Credit
- ☐ Other incentives or instruments

Financial/ material support provided to land users

The project and governmental counterparts (department) provide material and technical support. The community provides in-kind contribution through labour and local material for the implementation of the measures/ technology.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *The approach supports land and water users to make decisions regarding water use on their own.*				✓
Did the Approach enable evidence-based decision-making? *The preparation stage includes analysis, where information for evidence and later decisions is collected. Once the effectiveness of the approach is recognised, it can be replicated by other communities themselves.*			✓	
Did the Approach help land users to implement and maintain SLM Technologies? *Land users are involved in the implementation and maintenance of the prioritised measures in the WUMP plan, which is efficient use water for production and drinking purposes.*			✓	
Did the Approach improve coordination and cost-effective implementation of SLM? *The WUMP provides options for cost sharing mechanisms amongst different actors, to attract funding for prioritised initiatives. The prioritised initiatives of WUMP are jointly implemented by different stakeholders, which can reduce costs.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The results of WUMP (measures) are included in the official departmental annual development plans and budgets.*		✓		
Did the Approach improve knowledge and capacities of land users to implement SLM? *The land and water users learn how to analyse and assess water resources. They learn about options to address the identified challenges.*				✓
Did the Approach improve knowledge and capacities of other stakeholders? *Similarly, all other involved stakeholders learn how to analyse and assess water resources and understand options to address them.*			✓	
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *By establishing a district coordination committee to steer the approach (WUMP) all stakeholders can jointly discuss, address their needs and suggest options to be prioritised.*			✓	
Did the Approach mitigate conflicts? *Through this approach all stakeholders - especially the upstream & downstream users - can resolve their water-related disputes through dialogue. This contributes to resolving disputes between communities and concerned department.*				✓
Did the Approach empower socially and economically disadvantaged groups? *Disadvantaged groups participate in the preparation process of the plan, where they reflect and contribute with their concerns, needs and priorities.*				✓
Did the Approach improve gender equality and empower women and girls? *Same participation as the disadvantaged groups. Women are also part of the decision-making body.*			✓	
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *Same participation as the disadvantaged groups. Generally people of the age group 30-45 are the leaders of associations - supported by their elders - to address and develop water resource management of their villages.*				✓
Did the Approach lead to improved food security/ improved nutrition? *Through the approach water efficient technologies are promoted, which lead to increase in production and improve food security.*				✓
Did the Approach lead to improved access to water and sanitation? *Through the approach, options to improve access to water for domestic use are promoted. Access to clean drinking water at household level contributes to improved sanitation.*				✓
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? *The result of the WUMP approach is a set of options, where efficient use of water and water saving technologies are promoted e.g. water harvesting.*				✓

Main motivation of land users to implement SLM

- ✓ increased production
- ✓ increased profit(ability), improved cost-benefit-ratio
- ✓ reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- ✓ rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- ✓ environmental consciousness
- customs and beliefs, morals
- ✓ enhanced SLM knowledge and skills
- aesthetic improvement
- ✓ conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: For the prioritisation of technologies implemented through WUMP, options which require only minimal external inputs and are easy to sustain by the land users, where promoted.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Participatory and inclusive process, which ensures ownership by local actors, promotes coordination and fosters partnerships between different actors.
- The proritised measures selected through the WUMP approach promote sustainable use of water resources through water conservation and efficient water use.

Key resource person's view

- Strengthening of local institutional capacities, establishment of an inventory/ data used as a baseline in the water sector.
- Flexible - for improvement, since the WUMP is reviewed each 3-5 years.
- Offcially recognised and accepted planning tool at regional level, which provides opportunities for investment by other actors based on communities' priorities.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Time consuming preparation process, high initial cost for the preparation. → *Ensure planning is a continuous process.*
- Lack of technical capacity at local level. → *Capacity building training of local institutions (VOs/ WUAs/ WUGs) in planning. Provide support at local level through the project and govt. extension services.*

Key resource person's view

- Replication and upscaling require tailor-made adjustments. → *Technical capacity building of govt. departments. WUMP application at large scale in areas (big catchment areas, limited access).* → *Lobbying for support and resources at different governmental level.*
- Significant mobilisation of resources by other stakeholders for implementation. → *Inclusion of WUMP priorities by the govt. department in their respective annual development plans.*

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Links to relevant information which is available online:

Water Use Master Plan (WUMP) Project experience Nepal, HELVETAS Swiss Intercooperation Nepal: https://assets.helvetas.org/downloads/13_waterusemasterplan_wump_blau_final_engl_a4_portrait.pdf
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Water flow around Terra Preta raised garden beds, limiting erosion and facilitating infiltration (Karl Harald Bier).

Terra Preta raised garden beds (Haiti)

Jaden kolin, Tè mirak

DESCRIPTION

Terra Preta raised garden beds are a combination of techniques from permaculture and the production of Terra Preta, an anthrosol. These garden beds, created from local resources, are highly fertile and enable the production of much higher yields than traditional techniques, while diminishing runoff and soil erosion.

One of the major problems in the mountainous rural zones of the municipality of Léogâne in Haiti is the severe degradation and erosion of soils. The high runoff and soil loss increases the vulnerability of the local population, who are mainly farmers. The Terra Preta raised garden beds were introduced into this region after the earthquake of 2010, and were replicated by several organisations and also by members of the communities. They are derived from two main techniques: 1) Terra Preta is a method of creating soils based on a lacto-acidic fermentation of organic matter with charcoal powder. It was used historically by indigenous people in the Amazon, and then rediscovered and replicated recently by scientists. The technique is characterised by the use of local resources to produce a high fertility growth medium. Through this technique, a soil layer of several decimetres can be produced in a few years, compared with natural processes that take around 100 years per centimetres. Soil analyses show that the formation of humic acids can be demonstrated after four months. 2) Raised garden beds (of 40-50 cm) or 'hugelculture' are a technique used in permaculture. Permaculture is a science that combines agricultural and social systems the principles of ecology and the knowledge of tradition ecosystems. Raised garden beds consist of an interior of ligneous material, covered by a layer of earth. The elevated construction facilitates the work in the garden a nd the decomposition of wood inside the beds. Due to their spongy structure, the raised garden beds function as a water reservoir during dry periods. The garden beds are placed perpendicularly to the slope direction as much as possible, and are arranged alternately, with an extension to redirect the surface runoff preventing the water from draining directly. This promotes infiltration of water into the soil, where it is captured by the ligneous material, which prevents the water from draining directly out of the system and prevents erosion. The inputs for the garden beds can be found locally: organic matter, ligneous material, dry straw, fresh straw, harvest residues, organic residues rich in mineral nutrients (kitchen waste, animal waste, etc.); charcoal powder (biochar), ashes or other fertile materials. With these materials, which are generally without cost and locally available, a raised garden bed can be set up in less than an hour. Even without additional fertilization after the set-up, the technique supports several cycles of vegetable production. Experiments have shown good results over four years of continuous plantation in Thozin (Grand Goâve). In order to ensure soil fertility for many years, further organic matter can be added later. It can be easily incorporated below the first layer of soil, and then decomposition takes place automatically. When established on sloping terrain, the garden beds slow down erosion significantly, and can serve to protect houses from runoff. The technique is valued be cause of its cost-effectiveness and its sustainability compared to conventional techniques. The complexity of the implementation can be a limiting factor to replication by other farmers: they observe the layout and think they can reproduce it without taking account of all the details which are essential for effective function of the system. This is why a certain level of support by technicians is required.

LOCATION



Location: Municipality of Léogâne, West department, Haiti

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites

- 2.50668, 18.39493
- 2.60135, 18.37913
- 72.60993, 18.38141
- 72.63607, 18.40519
- 72.65267, 18.40128

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: less than 10 years ago (recently)

Type of introduction

- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

Swiss Red Cross



Terra Preta gardens on slope (Karl Harald Bier).



Comparison of vegetables produced on local soil (left) and on Terra Preta (right) (Swiss Red Cross).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Cropland - Annual cropping
Main crops (cash and food crops): Vegetables (for example pepper, cabbage, spinach, tomato, chili pepper)

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 2
Land use before implementation of the Technology:
The technology enables the production of vegetables on land that was not productive before (degraded soils, sandy or inert substrates). This allows farmers to diversify from their traditional crops of maize, peas, sorghum, sweet potato with vegetables.
Livestock density: n.a.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- ✓ restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion, Wg: gully erosion/ gullying



biological degradation - Bl: loss of soil life

SLM group

- integrated soil fertility management
- cross-slope measure
- home gardens

SLM measures



agronomic measures - A2: Organic matter/ soil fertility, A3: Soil surface treatment



structural measures - S2: Bunds, banks

TECHNICAL DRAWING

Technical specifications

1. Terrain analysis: The first step in the construction is the terrain analysis: what is the size of the plot, the relief, the environment (vegetation, buildings, water courses) and which resources are available (water, biochar, vegetation, animals, organic residues)? Specific needs and social aspects, for example the neighbourhood and land holdings must also be considered.
2. Developing a land use plan: The second step is developing a land use plan: definition of the position of the garden beds, of the protection measures (against water flow, wind, sun and heat), and of the vegetables to grow.
3. Construction of the garden beds: After the preparatory work, the construction of the garden beds begins.
   - A trench of approximately 10 cm depth is dug (width of 1-1.2 m, length varied, height of around 40-50 cm).
   - The ligneous materials (decomposing wood) are arranged to create a mound. Holes between the materials should be filled with earth.
   - The organic matter is added in layers in the following order: dry straw, animal waste, pulse crops and organic matter rich in nutrients.
   - Charcoal powder can be added between the layers of rich organic matter, or even better, mixed with the latter.
   - A layer of earth of approximately 10 cm is added as cover.
   - During the process of construction, every layer should be watered.

The establishment of multiple garden beds is done as described above. The garden beds are installed in a layout that ensures runoff flows around them. This facilitates infiltration and the deposition of sediments. As a result, water is captured in the garden bed, and erosion is reduced.



Figure: Mariannina Oberhagen

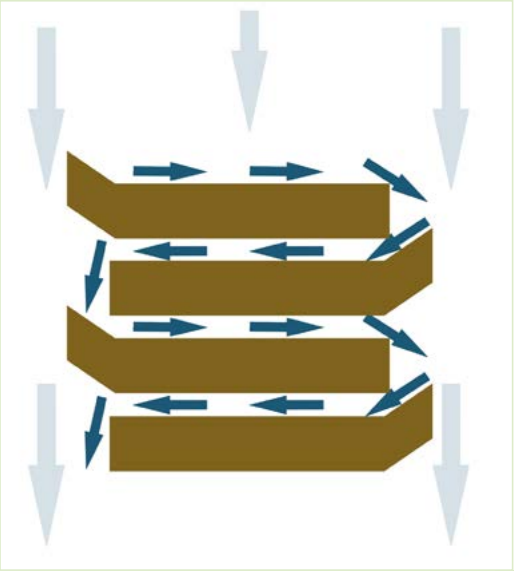


Figure: Karl Harald Bier

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit **(isolated structure volume)**, length: **width: 1.10 m; length: 10 m;** height:
- Currency used for cost calculation: **Haiti Gourde (HTG)**
- Exchange rate (to USD): 1 USD = 68.0 HTG
- Average wage cost of hired labour per day: 250 HTG.

Most important factors affecting the costs

Market fluctuation and scarcity of goods in the flood season.

Establishment activities

1. Layout of raised garden beds (Other measures; year-round)
2. Collection of materials (Other measures)
3. Digging a basin along the contour (Structural)
4. Building the different layers (wood, dry straw, fresh straw, pulse crops and organic matter rich in NPK, earth, charcoal powder) (Structural)
5. Planting out vegetable seedlings (Agronomic)
6. Watering (Agronomic)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Skilled labour (technical support)	person days	0.5	3000	1500	0
Unskilled labour (construction)	person days	1.0	250	250	100
Equipment					
Tools (spade, pickaxe)	piece	1.0	5	5	100
Plant material					
Seedlings of cabbage	seedling	10.0	10	100	0
Seedlings of spinach	seedling	20.0	5	100	0
Seedlings of tomato	seedling	10.0	5	50	0
Construction material					
Decomposing wood	batch	1.0	200	200	100
Earth	batch	1.0	50	50	100
Dry straw	batch	1.0	100	100	100
Fresh straw	batch	1.0	100	100	100
Animal waste	bag	1.0	100	100	100
Charcoal/ biochar	kg	50.0	2	100	100
Total costs for establishment of the Technology				**2655 HTG**	

Comment: The land users have the necessary tools (5 HTG are budgeted to compensate for the use of their own tools). The construction materials are also locally available, and are generally considered as waste.

Maintenance activities

1. watering (Agronomic; 3 days)
2. weeding (Agronomic)
3. mulching (Agronomic)
4. refertilisation (Agronomic)

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Annual maintenance	person days	15.0	250	3750	100
Equipment					
Watering device	piece	1.0	150	150	100
Plant material					
Seed and seedlings	various	1.0	250	250	100
Total costs for maintenance of the Technology				**4150 HTG**	

Comment: The indicated costs for the seed and the seedlings are the costs on the local market, but the land users produce these from plants that they received from the project for the first raised bed.

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1000 mm
- ☑ 1001-1500 mm
- ☐ 1501-2000 mm
- ☐ 2001-3000 mm
- ☐ 3001-4000 mm
- ☐ > 4000 mm

Agro-climatic zone

- ☐ humid
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

There is a dry season from December to February and a rainy season from April to October, with two peaks at the start and at the end of the period, and a relative pause in July.

Slope

- ☐ flat (0-2%)
- ☐ gentle (3-5%)
- ☐ moderate (6-10%)
- ☐ rolling (11-15%)
- ☐ hilly (16-30%)
- ☑ steep (31-60%)
- ☑ very steep (>60%)

Landform

- ☐ plateau/ plains
- ☑ ridges
- ☐ mountain slopes
- ☑ hill slopes
- ☐ footslopes
- ☐ valley floors

Altitude

- ☐ 0-100 m a.s.l.
- ☑ 101-500 m a.s.l.
- ☑ 501-1000 m a.s.l.
- ☐ 1001-1500 m a.s.l.
- ☐ 1501-2000 m a.s.l.
- ☐ 2001-2500 m a.s.l.
- ☐ 2501-3000 m a.s.l.
- ☐ 3001-4000 m a.s.l.
- ☐ > 4000 m a.s.l.

Technology is applied in

- ☐ convex situations
- ☐ concave situations
- ☑ not relevant

Soil depth
- [x] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [ ] medium (1-3%)
- [x] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [x] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [ ] yes
- [x] no

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [ ] medium
- [x] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [x] very poor
- [ ] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [x] elderly

Area used per household
- [x] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village group
- [x] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [x] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor	✓			good
education	poor	✓			good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor		✓		good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor	✓			good
financial services	poor	✓			good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

crop production	decreased	increased	**Comment:** The yield usually increases 2-3 times with the introduction of the technique.
crop quality	decreased	increased	**Comment:** The crops are more healthy and more resistant to diseases. The quality of the vegetables is better, and clients at the market of Grand Goâve pay more for the products from Terra Preta.
product diversity	decreased	increased	**Comment:** The majority of people in the area are not used to vegetable growing. The technique makes it possible to grow vegetables which increase the nutritional base (rice, pearl millet, sweet potato and peas).

production area (new land under cultivation/ use)	decreased	increased ✓	**Comment:** Normally, the soils are not used for crop production. Through the technique, a productive area is created. In addition, the surface increases through the undulating shape of the garden beds.

Ecological impacts

water quantity	decreased	increased ✓	**Comment:** a) The inf iltration of water into the soil is facilitated. b) The water is retained by the organic matter in the garden beds (especially by the decomposing wood).
surface runoff	increased ✓	decreased	
soil moisture	decreased	increased ✓	**Comment:** Water runoff and erosion is slowed down and reduced by the garden beds, and the sediments are deposited in front of these. However, the size of the garden beds is limited, and in order to combat erosion on a larger scale additional technologies must be considered, like vegetative barriers or terracing.
soil accumulation	decreased	increased ✓	
soil compaction	increased ✓	reduced	
soil organic matter/ below ground C	decreased ✓	increased	**Comment:** Soil analyses sample 1: 0.93%- >3.50% sample 2: 2.04% - >5.51%
drought impacts	increased ✓	decreased	**Comment:** In the dry periods, the technique permits continuation of crop production for several weeks without irrigation.
emission of carbon and greenhouse gases	increased ✓	reduced	**Comment:** Sequestered in the soil by the charcoal and the organic matter (especially the ligneous material).

Off-site impacts

water availability (groundwater, springs)	decreased ✓	increased
damage on public/ private infrastructure	increased ✓	reduced

Benefits compared with establishment costs

Short-term returns	very negative	very positive ✓
Long-term returns	very negative	very positive ✓

Benefits compared with maintenance costs

Short-term returns	very negative	very positive ✓
Long-term returns	very negative	very positive ✓

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Climate-related extremes (disasters)

tropical storm	not well at all	very well ✓
local rainstorm	not well at all	very well ✓
local thunderstorm	not well at all	very well ✓

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- ✓ 1-10%
- 10-50%
- more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- 0-10%
- 10-50%
- ✓ 50-90%
- 90-100%

Number of households and/ or area covered

>300 households

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view
- Strongly increased yield immediately after establishment.
- Improved product quality (size, taste).
- Shortened crop cycle.

Key resource person's view
- Increased production (several times) Improved nutrition.
- Income generation for the farmers.
- Shortened production cycle.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view
- More work than traditional techniques. The latter are focused on agricultural production in fields (maize, pearl millet, sweet potato, peas/beans), and require considerably less daily maintenance.→ *By having the gardens close to the house for follow-up and support.*

Key resource person's view
- Complexity of the technique. → *Regular education, follow-up and continuous support.*

REFERENCES

Compiler: Karl Harald Bier - Harald.Bier@redcross.ch
Resource persons: Karl Harald Bier (Harald.Bier@redcross.ch) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_935/
Linked SLM data: SLM Approach: Approach at household level for Terra Preta homegardens https://qcat.wocat.net/en/wocat/approaches/view/approaches_1953/
Documentation was facilitated by: Swiss Red Cross - Switzerland

Key references

Terra Preta: Production. Guide des mthodes de la production de Terra Preta dans les jardins potagres. Karl Harald Bier. 2013.: Welthungerhilfe Pas de la mise en place d'un Jardin Colline TP. Karl Harald Bier. Swiss Red Cross: info@redcross.ch

Links to relevant information which is available online:

Terra Preta - Charbon bio - Climatefarming, Hans-Peter Schmidt, 2008, ISSN 1663-0521: http://www.ithaka-journal.net/climatefarming-fr1?lang=f



Joint visit between technicians of the Swiss Red Cross and beneficiaries of the Terra Preta demonstration gardens (Helen Gambon, Swiss Red Cross).

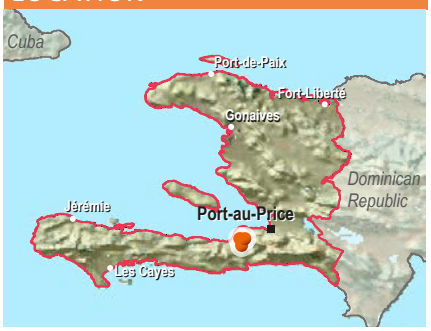
Approach at household level for Terra Preta homegardens (Haiti)

DESCRIPTION

The approach described here is to facilitate the extension of the Terra Preta homegardens at household level among the vulnerable population in the rural zones of the municipality of Léogâne, Haiti. It is based on demonstration gardens created together with members of Grassroots Community Organisations (GCO).

One of the key problems of the Haitian rural population is related to the intensive use of the soil, and its degradation due to the high demographic pressure in the mountainous zones. This intensifies the effects of natural hazards, especially those linked to extreme hydrological and meteorological events. The severe degradation decreases agricultural production. Because agriculture is the major income source of the rural population of the community of Léogâne, chronic malnutrition is one of the most important health problems. The Swiss Red Cross promotes Terra Preta at household level to address several factors of vulnerability. Terra Preta is an innovative technology that creates and fertilizes soils through the recovery of organic waste. The approach for dissemination of the technology functions is as follows: initially, the active and interested members of grassroots community organisations receive theoretical training (one day) which covers various aspects. First, definition and origin of the Terra Preta technology, then an introduction to the different structures created (garden beds and garden surfaces), the materials used, the implementation procedures, practical experience in Haiti and the advantages of the technology. Next, a homegarden is created with the cooperation of trained farmers. Then, together with the members of the grassroots community organisation, who show interest after this first cycle of training, private gardens are implemented at the household level. The establishment of the first structure (which is a mound and/ or a surface) for a family is carried out by the project team, demonstrating the necessary steps to the beneficiary, who contributes with labor. After some time, the second structure is established in a similar way. For the establishment of the third structure, the beneficiary coordinates the work, and the team provides support or corrections if necessary. Generally a farmer is ready to do the replication him/ herself from the fourth structure onwards. These example homegardens serve as demonstration plots for other families in the community. If a family shows interest in implementing a Terra Preta homegarden, the project team provides the technical support as described in the following. Seed production: the first seedlings are donated by the project to the families. The families are then trained in the production of seed and the creation of nurseries for vegetables. In this way, the project aims to contribute to the food self-sufficiency of the families. Gender: generally the men are in charge of the establishment of homegardens in Haiti. However it is recommended to involve women in the maintenance of the gardens. Experience shows that women are often more engaged then men, and it is more probable that the vegetables produced will be used to feed the family instead of being sold.

LOCATION



Location: Cormier, Fond de Boudin, Palmiste-à-Vin, Fond' Oie, Petit Harpon, Municipality of Léogâne, Haiti

Geo-reference of selected sites
- 72.57126, 18.45382
- 72.61726, 18.44014
- 72.59323, 18.39487

Initiation date: 2014

Year of termination: n.a

Type of Approach

☐ traditional/ indigenous
☐ recent local initiative/ innovative
☑ project/ programme based

CROIX-ROUGE HAITIENNE

Swiss Red Cross



Establishment of a Terra Preta homegarden by a grassroots community organisation with support from a technician of the Swiss Red Cross (Karl Harald Bier).



Training about the Terra Preta technique (Karl Harald Bier).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The creation and fertilization of soils, through the recovery of organic waste and residues, contribute to the resilience of families, an increase of food self-sufficiency and a reduction of malnutrition.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **institutional setting:** The approach to strengthen the capacities of grassroots community organisations fosters the implementation of Terra Preta homegardens.
- **collaboration/ coordination of actors:** Strict planning and monitoring are essential for the collaboration and coordination between the actors. The trust between the beneficiaries (GCO and individual households) and the technical team of the Swiss/ Haitian Red Cross is the foundation for the sustainable implementation of Terra Preta homegardens.
- **knowledge about SLM, access to technical support:** Terra Preta homegardens are an innovative technology which was not known before in the community.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The people in the region are not used to vegetable growing.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (Households in the intervention zone of the project 'Risk and disaster management' of the Swiss Red Cross):** Implementation, replication and maintenance of their homegardens.
- **community-based organisations (grassroots community organisations):** Implementation of demonstration gardens to motivate other families.
- **NGO (Swiss/Haitian Red Cross):** Technical and material support (seed or seedlings), monitoring.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
planning				✓	
implementation					✓
monitoring/ evaluation					✓

Flow chart

Process of knowledge transfer about the Terra Preta home-gardens by projects of the Swiss Red Cross.

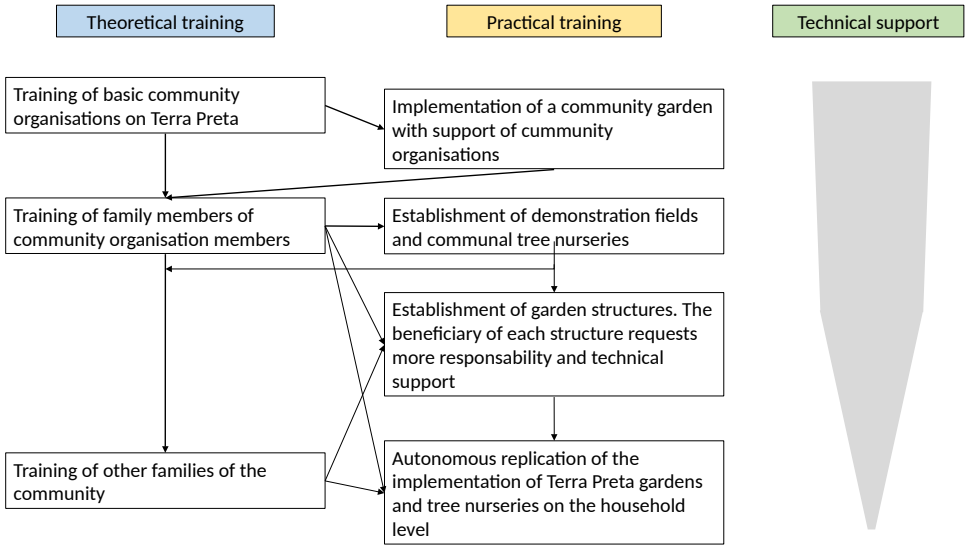


Figure: Helen Gambon, Swiss Red Cross

Decision-making on the selection of SLM Technology

Decisions were taken by

- ☐ land users alone (self-initiative)
- ☐ mainly land users, supported by SLM specialists
- ☐ all relevant actors, as part of a participatory approach
- ☐ mainly SLM specialists, following consultation with land users
- ☑ SLM specialists alone
- ☐ politicians/ leaders

Decisions were made based on

- ☑ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- ☐ research findings
- ☐ personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ☑ Capacity building/ training
- ☑ Advisory service
- ☑ Institution strengthening (organisational development)
- ☑ Monitoring and evaluation
- ☑ Research

Capacity building/ training

Training was provided to the following stakeholders

- ☑ land users
- ☐ field staff/ advisers

Form of training

- ☑ on-the-job
- ☐ farmer-to-farmer
- ☑ demonstration areas
- ☐ public meetings
- ☐ courses

Subjects covered

Definition and origin of Terra Preta, the different structures, the materials used, the procedures for the establishment, the practical experiences in Haiti, the advantages of the technology.

Advisory service

Advisory service was provided

- ☑ on land users' fields
- ☐ at permanent centres

Comment: The technical staff of the Swiss/ Haitian Red Cross provides continuous technical assistance to the beneficiaries (Grassroots Community Organisation and individual households).

Institution strengthening

Institutions have been strengthened/ established

- ☐ no
- ☑ yes, a little
- ☐ yes, moderately
- ☐ yes, greatly

at the following level

- ☑ local
- ☐ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.

The role of the grassroots community organisations is to motivate the community for development.

Type of support

- ☐ financial
- ☑ capacity building/ training
- ☐ equipment

Monitoring and evaluation

Monitoring and evaluation are an integral part of the projects of the Swiss/ Haitian Red Cross.

Research

Research treated the following topics

- [ ] sociology
- [ ] economics/ marketing
- [x] ecology
- [ ] technology

Comment: Collaboration with students from local universities (theses).

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [ ] 2000-10000
- [x] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Precise annual budget: n.a.

Major donor: Includes inputs like seed and seedlings as well as training. Main source of funding: the Swiss Red Cross.

The following services or incentives have been provided to land users

- [ ] Financial/ material support provided to land users
- [x] Subsidies for specific inputs
- [ ] Credit
- [ ] Other incentives or instruments

Subsidies for specific inputs (including labour)

Labour by land users was

- [x] voluntary
- [ ] food-for-work
- [ ] paid in cash
- [ ] rewarded with other material support

	partly financed	fully financed
agricultural: seeds		✓

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation?		✓		
Did the Approach enable evidence-based decision-making? *The demonstration plots have helped to motivate households to implement vegetable gardens.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *The approach has introduced an innovative technology for Sustainable Land Management, which serves to create and fertilize soils which retain water.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The access to financial resources is not an objective of the approach.*	✓			
Did the Approach improve knowledge and capacities of land users to implement SLM? *30-40% of the beneficiaries are in a position to replicate the technology by themselves.*			✓	
Did the Approach improve knowledge and capacities of other stakeholders? *The Grassroots Community Organisations replicate the Terra Preta homegardens and support families in the establishment of the gardens.*			✓	
Did the Approach build/ strengthen institutions, collaboration between stakeholders?		✓		
Did the Approach mitigate conflicts?	✓			
Did the Approach empower socially and economically disadvantaged groups? *The objective of the approach is to empower the most vulnerable people first.*		✓		
Did the Approach improve gender equality and empower women and girls? *Often women look after the gardens, which gives them the possibility of contributing to the needs of the families.*		✓		
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *The education of students in agronomy is part of the approach.*			✓	
Did the Approach lead to improved food security/ improved nutrition? *The vegetables grown in the gardens contribute much to food security and diversification of nutrition.*				✓
Did the Approach improve access to markets? *The approach does not have a primary goal of improving the access to markets, but some beneficiaries have been able to profit from it by selling surplus products. The gardens offer the possibility of generating harvests in a short time, which contributes (for example) to rapid rehabilitation after hurricanes. Because the gardens function as water reservoirs, the vegetative period is extended by several weeks, and the gardens can resist drying out.*		✓		

Main motivation of land users to implement SLM

- [x] increased production
- [ ] increased profit(ability), improved cost-benefit-ratio
- [x] reduced land degradation
- [ ] reduced risk of disasters
- [ ] reduced workload
- [ ] payments/ subsidies
- [ ] rules and regulations (fines)/ enforcement
- [ ] prestige, social pressure/ social cohesion
- [ ] affiliation to movement/ project/ group/ networks
- [ ] environmental consciousness
- [ ] customs and beliefs, morals
- [ ] enhanced SLM knowledge and skills
- [ ] aesthetic improvement
- [ ] conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- [ ] no
- [x] yes
- [ ] uncertain

Comment: A number of beneficiaries are already able to replicate the technology on their own. As the project continues, the Swiss/Haitian Red Cross aims to augment the number of households capable of replicating the technology.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- There is high confidence in the technical staff, because of their continuous presence in the field.
- The approach strengthens the capacity of the households to become self-sufficient and to improve food security.

Key resource person's view

- The approach promotes the extension of the technology.
- The demonstration plots serve as motivation for some beneficiaries.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- The availability of materials for the implementation of the Terra Preta gardens is not always guaranteed, and the collection (e.g. of wood) takes time. → *Awareness-raising and motivation by the technical staff. The planning of activities must be done jointly by the technical staff and the beneficiaries.*

Key resource person's view

- The availability of vegetable seeds is not always guaranteed in the local market. → *The beneficiaries learn how to produce their own seeds from their vegetables.*
- Recurrent droughts can hamper the development of the gardens. → *In the dry zones, the gardens are preferably implemented close to a water source. In the established gardens, mulching can be carried out.*

REFERENCES

Compiler: Helen Gambon - helen.gambon@redcross.ch

Resource persons: Evale Guetchine Jean (guetchine04.jean@gmail.com) - SLM specialist; Jean-Carls Dessin (jcarls.dessin@redcross.ch) - SLM specialist; Karl Harald Bier (Harald.Bier@redcross.ch) - SLM specialist

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_1953/

Linked SLM data: SLM Technology: Terra Preta raised garden beds https://qcat.wocat.net/en/wocat/technologies/view/technologies_935/

Documentation was facilitated by: Swiss Red Cross - Switzerland

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/ tsunami			✓		
Mass movement	✓				
Hydrological					
Flooding		✓			
Landslide	✓				
Meteorological					
Thunderstorm		✓			
Tropical storm/ cyclone			✓		
Biological hazards					
Epidemics (human)		✓			
Pest (vegetation)			✓		
Climatology					
Drought			✓		
Man-made hazards					
Fire	✓				
Structure failure			✓		

Vulnerability – capacity profile of the site before the Approach was applied

Exposure							
of people	very high/ strong	✓					very low/ non-existent
of private assets	very high/ strong	✓					very low/ non-existent
of community land	very high/ strong						very low/ non-existent
of community infrastructure	very high/ strong	✓					very low/ non-existent
Economic factors							
Access to markets	very high/ strong				✓		very low/ non-existent
Income	very high/ strong					✓	very low/ non-existent
Diversification of income	very high/ strong					✓	very low/ non-existent
Savings/stocks	very high/ strong					✓	very low/ non-existent
Bank savings/remittances	very high/ strong			✓			very low/ non-existent
Degree insurance coverage	very high/ strong					✓	very low/ non-existent
Social factors							
Literacy rate	very high/ strong					✓	very low/ non-existent
Government support	very high/ strong					✓	very low/ non-existent
Family support	very high/ strong			✓			very low/ non-existent
Community support	very high/ strong				✓		very low/ non-existent
Access to public services	very high/ strong				✓		very low/ non-existent
Physical factors							
Robustness of houses	very high/ strong					✓	very low/ non-existent
Robustness of infrastructure	very high/ strong					✓	very low/ non-existent
Other vulnerability factors							
	very high/ strong						very low/ non-existent

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- [ ] substantial increase in losses
- [x] some increase in losses
- [ ] no change
- [ ] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1	[ ] 1
[ ] 2-5	[ ] 2-5
[ ] 6-10	[ ] 6-10
[x] 11-50	[ ] 11-50
[ ] > 50	[x] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[ ] 11-50	[ ] 11-50
[ ] 51-100	[ ] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[x] > 500	[x] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[x] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[ ] 51-80%	[x] 51-80%
[ ] 80-100%	[ ] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[x] 51-80%	[x] 51-80%
[ ] 80-100%	[ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[ ] 0 USD	[ ] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[ ] 1001-5000 USD	[ ] 1001-5000 USD
[ ] 5001-10’000 USD	[ ] 5001-10’000 USD
[ ] 10’001-50’000 USD	[ ] 10’001-50’000 USD
[ ] 50’000-250’000 USD	[ ] 50’000-250’000 USD
[x] > 250’000 USD	[x] > 250’000 USD

Duration since last disaster

- [ ] < 3 months
- [x] 3-6 months
- [ ] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

IMPACTS

Additional benefits of the Approach

			Comment:
Safety (on-site)			
Safety of people	decreased	increased	
Evacuation and shelter	decreased	increased	
Safety of esp. vulnerable	decreased	increased	
Early warning	decreased	increased	
Safety of key documents	decreased	increased	
Economic goods (on-site)			
Safety of individual housing	decreased	increased	
Safety of water stocks	decreased	increased	
Safety of seed/animal stocks	decreased	increased	
Safety of land assets	decreased	increased	
Safety of communal assets	decreased	increased	
Other impacts (on-site)			
Recovery after an impact	incr./decr.	incr./decr.	*A crop loss had a major impact on the life of the people. There are 2 growing seasons so one crop loss equals 6 months of food lost.*
	incr./decr.	incr./decr.	
Off-site impacts			
	incr./decr.	incr./decr.	
	incr./decr.	incr./decr.	



Keyhole garden resisting flooding (Shahid Kamal).

Keyhole garden (Bangladesh)

Pusti Bagan ("Garden for nutrition")

DESCRIPTION

Keyhole gardens are built near homesteads in floodplains and consist of circular vegetable gardens with a diametre of approximately three metres raised on a plinth to withstand floods and droughts. They enhance the resilience of families in areas with climate-related hazards. Keyhole gardens increase vegetable production, thereby improving household food autonomy and dietary diversity.

Keyhole gardens are shaped like a horseshoe or keyhole, with a diamet er of approximately three metres. For flood-prone areas in Bangladesh and India, the plinth height depends on the location and is typically the same as the house plinth to resist flooding. Soil is added to the plinth and a compost basket is built at the centre of the garden. Organic matter (kitchen waste) and residual water are added on a regular basis to the compost pit. The keyhole garden is a typical Low External Input Sustainable Agriculture (LEISA) system that integrates composting, water retention, use of local materials, natural pest and disease control techniques, natural soil fertility measures, and proximity to the kitchen for both harvesting and care of the garden. It is is a good way to enhance dietary diversity, especially for poor/ landless families. In regions with mild conditions of flooding, tidal surges and drought, the garden increases the duration of the gardening period during the year, thus reducing the risk of disaster. In the aftermath of cyclone Mahasen, keyhole gardens demonstrated their DRR utility: while many were partially damaged, none had to be rebuilt entirely. Where plants did not survive the storm, users were able to resow seeds immediately. On the other hand, the traditional ground-level plots used for pit and heap gardening were completely flooded/ waterlogged and unusable. The benefits of the technology include: compact size, proximity to the household for convenient maintenance and harvesting, composting of kitchen peelings in the basket; and an ergonomic structure (raised, accessible). The small size is also ideal to facilitate training about vegetable growing, soil fertility and pest & disease management to first-time gardeners and students in schools. Keyhole gardens are highly productive – in Lesotho a typical garden can satisfy the vegetable needs of a family of eight persons (FAO, 2008). Combined, these factors are scalable as an appropriate method to landless and marginal farmers. In Bangladesh, the gardens enabled families to produce vegetables even during the monsoon period. As the keyhole garden normally does not need to be rebuilt every year it is a more efficient technique in the long-term than traditional methods such as pit and heap. Users say that their garden produce tends to be larger and tastier than conventional gardens or market products; and many have indicated that they are able to meet their own vegetable consumption needs and to sell surplus – or even to gift – vegetables. For some women it has proved difficult to access sufficient amounts of soil, which means that they need to walk long distances to build the plinth (fortunately many have received support from other villagers). Secondly, during the monsoon, while most of the land is flooded, the keyhole garden remains dry. Consequently, it may provide shelter to certain animals (e.g. rats) and attract pests. Regardless of these two limitations users agree that the benefits greatly outweigh any observed limitations. First initiated in Ugandan communities by Send a Cow UK, the keyhole garden technique is widespread in Africa. In 2011, Terre des hommes (Tdh) and Greendots piloted Wocat SLM Technologies keyhole gardens for the first time in Asia, effectively adapting the design and methodology in Africa to the conditions of flood prone areas of Bangladesh, and eventually India.

LOCATION



Location: Kurigram municipality ram), Patharghata Union (Barguna), Kurigram District / Rajshahi and Barguna District/ Barisal, Bangladesh

No. of Technology sites analysed: 100-1000 sites

Geo-reference of selected sites

- 89.6487, 25.81035

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: 2012

Type of introduction

- ✓ through land users' innovation
- ☐ as part of a traditional system (> 50 years)
- ✓ during experiments/ research
- ✓ through projects/ external interventions

Greendots simple food autonomy

Terre des hommes Helping children worldwide.



Diversity is at the heart of this technology: increased crop diversity for a healthier garden and increased dietary diversity for a healthier person (Sultana Al-Amin).



Keyhole gardens are resilient to flooding as the area where the vegetables are planted is raised on a plinth (Sultana Al-Amin).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact

Land use



Cropland - other (specify): Homestead Gardening
Main crops (cash and food crops): Winter Season: red amaranth, spinach, green chilli, tomato, eggplant, carrot, radish, onion, garlic, country bean, pumpkin, cabbage, cauliflower, broccoli. Summer & Rainy Seasons: red amaranth, green amaranth, Indian spinach, Chinese watercress, green chili, okra, eggplant, yard long bean, bitter gourd, ash gourd, cucumber, pumpkin.

Water supply

- rainfed
- ✓ mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 3
Livestock density: n.a.

Purpose related to land degradation

- ✓ prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion

SLM group

- integrated soil fertility management
- integrated pest and disease management (incl. organic agriculture)
- home gardens

SLM measures



agronomic measures - A1: Vegetation/ soil cover, A2: Organic matter/ soil fertility



structural measures

Technical specifications

Gardens should be built in close vicinity to the beneficiary's house, because gardens that are easily accessible and clearly visible are visited more regularly and maintained better.

The design is well adaptable to local conditions and availability of free construction materials. The radius of the garden is 150cm and the delineated radius of the circular compost basket (in the center of the garden) is 45cm. The diagrams show (1) the location is near to house as an entry point for maintaining the garden; (2) the plinth is built to the same level of the house and a step is included where the plinth is high; (3) mulching to conserve moisture; (4) interplanting a diversity of vegetables for both good crop health and better family nutrition; (5) using interplanted natural repellent plants as pest control for vegetables; (6) covering the basket during times of high sun intensity or heavy rain; (7) using liquid manures and plant teas as top dressing fertilizers.

Establishing what is the best height for the plinth very much depends on the local climatological conditions. In Bangladesh, the plinth is built from subsurface clayey soil, typically 2-3 feet (60-90 cm) in height - dependent on the location and level of seasonal flooding. The house plinth is a good gauge for how high to build the garden plinth. If the plinth is built too high, the roots of the plant will not be able to access sufficient water; and if built too low the next flood during the monsoon season may destroy the garden. Depending on dryness or soil/ groundwater salinity, daily maintenance usually includes irrigating the soil. The outer rim of the plinth is protected with mud (and plastic or cloth) or stones. On top of the plinth is a mixture of soil and compost/manure (ratio 2:1) sloping up to the basket at a 30 - 40 degree angle. The central compost basket is filled with layers of fresh and dried vegetable matter, manure and ash to ensure the soil fertility of the garden.

Women have devised a number of different solutions to protecting the wall of the plinth and garden: Plastic bags, a combination of rice sacks (around the plinth edge) and plastic entrance way because of wear and tear (rice sacks erode faster), palm matting and old cloth. Some women put extra manure in the plinth walls to protect against flooding.



Figure: Sam Rich: www.fourthway.co.uk



Figure: Sam Rich: www.fourthway.co.uk



Figure: BBC Media Action Bangladesh

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit: **1 Keyhole Garden**
- Currency used for cost calculation: **US Dollars**
- Average wage cost of hired labour per day: USD 2.50.

Most important factors affecting the costs

Over the last few years, people in disaster-affected areas of Bangladesh have become familiar with receiving money during humanitarian distributions; and expect "hand-outs" if they are to participate in a development project. The Keyhole garden project, however, follows the LEISA approach and does not rely on giving free inputs to the participants. (In a few cases where the local population was lacking seeds and experience in seed production, womens' groups were given seeds and training.) A lack of reliance on external inputs or subsidies contributes to the sustainability of the project. The inputs (clay, manure, sticks, rocks, etc.) are locally available and usually do not require additional expenses. This may not be the case in all contexts.

Establishment activities

1. Clear land; mark out basket and external boundary (using rope and stick pivoted from the centre) (Structural; Anytime)
2. Build plinth (highest monsoon flood level + 30cm); (Structural)
3. Construct basket at the centre from local materials. Fill basket with composting materials; (Structural)
4. Bring soil and heap it around the central basket. Any available animal dung can also be added into the soil mix for greater initial productivity. (Structural)
5. Plant vegetable seeds around the garden - a mix for good family nutrition and to stop the spread of pests and diseases; (Agronomic)
6. Mulch between plants to protect the soil. (Agronomic)
7. Protect the walls with rice sacks or other waterproof protection if necessary. (Structural)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Building the garden	person days	3.0	2.5	7.5	100
Construction material					
Clay					
Total costs for establishment of the Technology				**7.5 USD**	

Comment: Firstly, building the garden requires an initial investment in terms of labour and (locally available) inputs, such as soil and wood and clayey soil for the plinth (stones and bricks are frequently used for the plinth in Africa). These inputs are available on the homestead or in the community and generally free of cost. In rare cases families paid to have soil carted to their homestead, thus increasing the initial structuring costs.

Maintenance activities

1. Weeding, harvesting, watering (Management; Daily)
2. Structural maintenance on the garden (Structural)

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Maintenance	person days	11.0	2.5	27.5	100
Structural maintenance on the garden	person days	1.0	2.5	2.5	100
Construction material					
Clay depends on height: ex. 4m plinth)	cubic metre	11.0			
Manure (quantity depends on design)	cubic metre	2.0			
Basket (sticks/bamboo with thin sticks to weave the basket	Sticks	15.0			
Protective material, rice bags/stones/plastic	Square metre	18.0			
Total costs for maintenance of the Technology				**30 USD**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [x] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [x] humid
- [x] sub-humid
- [x] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 2666.0
Applied in areas with monsoon and drought like conditions in the project areas in Bangladesh.
Name of the meteorological station:
http://data.worldbank.org/indicator/AG.LND.PRCP.MM
The technology is adapted to semi-arid areas/countries in Africa like Uganda and Tanzania.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [x] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [x] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [x] 101-500 m a.s.l.
- [ ] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [ ] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [x] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [x] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [x] yes
- [ ] no

Occurrence of flooding
- [x] yes
- [ ] no

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [x] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [x] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [x] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Water use rights
- [x] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [ ] individual

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

crop production	decreased ✓ increased	**Before SLM:** <5% of pilot families growing vegetables in all 3 seasons. **After SLM:** 50% of the pilot families able to grow vegetables in 3 seasons. **Comment:** Before the project started, the majority of the participants were not able to produce vegetables year round. Especially during the monsoon months, people were dependent on what was available at the local market. The baseline survey indicated that in both regions more than 50% of the households would cultivate vegetables for a maximum of 3 months per year and in Kurigram 30% of the participants were not able to grow vegetables at all. This situation has changed significantly after the introduction of the keyhole gardens. At least 50% of the households were able to produce vegetables during each season. Where in the past almost no-one was able to cultivate during the monsoon period, now on average 63% of the households in Kurigram and 73% of the households in Patharghata are growing vegetables in the wet season. The summer figures are actually lower than the monsoon figures. Seeds did not germinate well, because participants were not fully prepared to deal with the dry and saline conditions during this season. Learning from this experience, and with adequate support from Tdh, participants should be able to achieve higher cultivation rates in the future.
product diversity	decreased ✓ increased	**Before SLM:** Average of 2-4 types of vegetables grown. **After SLM:** Average of 6 types of vegetables grown. **Comment:** During the field visits and individual interviews in June 2013, the majority of the participants indicated that in the keyhole garden they usually grow 6 or more different types of vegetables at any given time. This is a marked difference from previous years, when the majority of people in Patharghata would only grow 2 types of vegetables. In Kurigram the baseline was somewhat higher (31% cultivated 4 types of vegetables per year on average), but still significantly lower than in 2013. By increasing the different types of vegetables grown, the families have access to a more diversified diet.
production area (new land under cultivation/ use)	decreased ✓ increased	**Before SLM:** 0 **After SLM:** 333 **Comment:** In addition to the 175 pilot keyhole gardens, an additional 158 gardens were started on homesteads either via the "peer to peer pass-on" system or spontaneous copy/ replication of the technology.

Socio-cultural impacts

health situation	worsened ✓ improved	**Comment:** The keyhole garden supports a diversified diet by enabling year-round vegetable production; thus boosting the resilience of homesteads exposed to extreme weather patterns (drought or monsoon/ flood seasons).
situation of socially and economically disadvantaged groups	worsened ✓ improved	**Comment:** Gardens will quickly increase houshold vegetable production, easing economic burden and providing for the houshold consumption or surplus to sell or gift. The latter can increase social bonding and benefit peer to peer linkages.

Ecological impacts

soil loss	increased ✓ decreased	**Comment:** Precious topsoil is not lost during flooding events.
food impacts	increased ✓ decreased	**Comment:** Gardens that are not submerged by floods continue to produce in the monsoon season.
other ecological impacts	none ✓ none	**Comment:** Surpluses can be used for selling or gifting; increased vegetables especially at times when they are not usually available enables families to save money on expensive purchases out of the normal vegetable season.

Off-site impacts

Teaching	reduced ✓ increased	**Comment:** Keyhole garden building and maintenance teaches lessons of good soil, water and vegetable management that can be transferred to field crops or plain large scale vegetable growing.

Benefits compared with establishment costs

Short-term returns — very negative ☐☐☐☐☐☐☑ very positive

Benefits compared with maintenance costs

Short-term returns — very negative ☐☐☐☐☐☐☑ very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

tropical storm	not well at all ☐☐☑☐☐	very well
local thunderstorm	not well at all ☐☐☐☑☐	very well
general (river) food	not well at all ☐☐☐☐☑	very well
storm surge/ coastal food	not well at all ☐☐☐☑☐	very well

Other climate-related consequences

reduced growing period	not well at all ☐☐☐☐☑	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☐ 1-10%
- ☐ 10-50%
- ☑ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ☐ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ☑ 90-100%

Number of households and/ or area covered

333 from the pilot study. Subsequent projects by Tdh from 2013-2015 have seen over 3'500 keyhole gardens created in Bangladesh and India.

Has the Technology been modified recently to adapt to changing conditions?

- ☑ Yes
- ☐ No

To which changing conditions?

- ☐ climatic change/ extremes
- ☑ changing markets
- ☐ labour availability (e.g. due to migration)

Comment: The technology was adapted from semi-arid zones in Africa (where soil amelioration and water conservation were priorities and materials such as stones and brick are available) to areas of South Asia prone to food and tidal surge.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Seasonal local agriculturalists reported that gardens yielded high productivity with good vegetable quality and diversity; withstood heavy monsoon rains lasting for several days; and withstood a salt water tidal intrusion that destroyed adjacent traditional gardens. During the FGDs women clearly expressed a lot of enthusiasm for the project and all the participants indicated that they would continue with their garden, even if Tdh would no longer provide any support. One volunteer reported successfully harvesting five common vegetables usually impossible to grow in monsoon conditions: - "In plain land we can cultivate once in a year but in keyhole garden we can harvest vegetables in three seasons and they don't go underwater in the rainy season" - "Save money for the family: don't need to buy fertilizers or vegetables and some people earn money by selling the garden product" - "We can collect vegetables for the children's requirements directly from the garden when they need them" - "In a small space you can have lots of different vegetables and the taste is much better because the garden depends on compost – no chemicals" - "The cost to make it is very low, but you need labour; by our own labour we can build it" - "Because of composting the garden can always get nutrients".

Key resource person's view

- The keyhole garden project has been very successful and has largely achieved its core objective to improve year-round access to nutritious food from the homestead area. These benefits are summarised again as: - Appropriate size for landless homesteads, also ideal to facilitate training on LEISA techniques to first-time gardeners and students in schools. -Proximity to the household for convenient maintenance and harvesting, composting of kitchen cuttings in the basket; -Ergonomic structure (raised, accessible). - Highly adaptable to local conditions that supports resilience to flood and drought conditions. - Highly productive - families produced vegetables even during the monsoon period. - As the keyhole garden normally does not need to be rebuilt every year it is a more efficient technique in the long-term than traditional methods such as pit and heap. Therefore, the reviewer did not suggest any major changes to the technique or project; rather to focus on specific issues that could help making the project more efficient and that could help broaden its impact.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- No major weaknesses in the technology or design were expressed. However for some women it was difficult to access sufficient amounts of soil, which meant that they needed to walk long distances to bring soil to build the plinth. In coastal areas where saline intrusion in groundwater and soils is on the rise, growing and irrigating crops is difficult in the dry season. → *Some women received support from other family members or neighbours; identify a support network for families having challenges to access soil to build the plinths. Continue to look for alternative irrigation sources and/or groundwater recharge innovations as well as soil conservation techniques to protect against salinity. Likewise, saline resistant vegetable varieties may be available.*

Key resource person's view

- More careful planning of the location for the keyhole garden is needed. In Patharghata 11 women decided to relocate their garden within the first year. This suggests that the women appreciate the benefits of the garden, but having to break down and move the garden is a rather laborious activity. Not surprisingly, women who have less time to work in the homestead area, e.g. due to work or other out-of-home responsibilities, are not able to maintain their keyhole garden well. → *Spend more time to assist the participants with identifying the most suitable locations to construct the garden for a keyhole garden in the homestead area at the start of the project. While maintaining a focus on women, involve the husband or other family members/ neighbours and ensure that they are also trained and ensure that the garden is clearly visible and can be accessed.*

REFERENCES

Compiler: John Brogan - john.brogan@tdh.ch
Resource persons: John Brogan (john.brogan@tdh.ch) - WASH/DRR Advisor; Daniel Varadi (daniel.varadi@greendots.ch) - SLM specialist; Sheila Taylor (sheila.taylor@greendots.ch) - SLM specialist; Shahid Kamal (shahid.kamal@bd.tdh.net) - WASH Advisor
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_779/
Linked SLM data: SLM Approach: Peer to peer pass-on approach with women https://qcat.wocat.net/en/wocat/approaches/view/approaches_784/
Documentation was facilitated by: Terre des Hommes (Terre des Hommes) - Switzerland

Key references

Keyhole Gardens: Improved Access to Homestead Vegetables and Dietary Diversification- External Evaluation and Capitalization of the Keyhole Garden Project in Bangladesh, Van Hout, R., 2013: Freely available: Terre des hommes Lausanne Asia Desk: info@tdh.ch
Keyhole Gardens – great potential for improving homestead crop diversity and mother & child nutrition, Taylor S, 2013, Discussion paper for the Agrobiodiversity Conference, Dhaka, 28 January 2013: Freely available: Terre des hommes Lausanne Asia Desk: info@tdh.ch
Keyhole Gardens in Lesotho, FAO Nutrition and Consumer Protection Divis"ion (AGN), 2008 (with Send a Cow UK): http://www.fao.org/ag/agn/nutrition/docs/FSNL%20Fact%20sheet_Keyhole%20gardens.pdf

Links to relevant information which is available online:

Greendots - Terre des hommes technical partner for Keyhole Gardens in South Asia: www.greendots.ch
Send a Cow UK: How to make an African style raised bed (YouTube, ex. Uganda): https://www.youtube.com/watch?v=ykCXfjzfaco
Send a Cow UK - Keyhole Garden resources (Learning from Africa: How to make a Keyhole Garden): http://www.sendacow.org.uk/lessonsfromafrica/resources/keyhole-gardens
Fourthway's posters online: Smallholder organic agriculture (Uganda, including Keyhole gardens): http://www.fourthway.co.uk/posters/
Fourthway's posters online: Smallholder organic agriculture (Bangladesh, including Keyhole gardens): http://www.fourthway.co.uk/bangladesh/index.html
Terre des hommes: First Keyhole Garden in Asia (to resist storm surge/floods in Bangladesh): https://vimeo.com/44043929

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		☑			
Tropical cyclone			☑		
Drought	☑				
Biological hazards					
None					
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

Exposure			
of people	very high/ strong	☑	very low/ non-existent
of private assets	very high/ strong	☑	very low/ non-existent
of community land	very high/ strong	☑	very low/ non-existent
of community infrastructure	very high/ strong	☑	very low/ non-existent
Economic factors			
Access to markets	very high/ strong	☑	very low/ non-existent
Income	very high/ strong	☑	very low/ non-existent
Diversification of income	very high/ strong	☑	very low/ non-existent
Savings/stocks	very high/ strong	☑	very low/ non-existent
Bank savings/remittances	very high/ strong	☑	very low/ non-existent
Degree insurance coverage	very high/ strong	☑	very low/ non-existent
Social factors			
Literacy rate	very high/ strong	☑	very low/ non-existent
Government support	very high/ strong	☑	very low/ non-existent
Family support	very high/ strong	☑	very low/ non-existent
Community support	very high/ strong	☑	very low/ non-existent
Access to public services	very high/ strong	☑	very low/ non-existent
Physical factors			
Robustness of houses	very high/ strong	☑	very low/ non-existent
Robustness of infrastructure	very high/ strong	☑	very low/ non-existent

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☑ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1	☐ 1
☐ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☑ 11-50	☐ 11-50
☐ > 50	☑ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☑ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☑ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☐ 21-50%	☐ 21-50%
☑ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10'000 USD	☐ 5001-10'000 USD
☐ 10'001-50'000 USD	☐ 10'001-50'000 USD
☐ 50'000-250'000 USD	☐ 50'000-250'000 USD
☑ > 250'000 USD	☑ > 250'000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☑ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Technology

In Bangladesh, families have the capacity to construct and maintain Keyhole gardens on their homesteads from locally available materials with the purpose of protecting their dietary diversity in the face of recurrent moderate-level floods and tidal surges.

IMPACTS

Additional benefits of the Technology

Safety (on-site)

Safety of people	decreased	☑	increased
Evacuation and shelter	decreased	☑	increased
Safety of esp. vulnerable	decreased	☑	increased
Early warning	decreased	☑	increased
Safety of key documents	decreased	☑	increased

Economic goods (on-site)

Safety of individual housing	decreased	☑	increased
Safety of water stocks	decreased	☑	increased
Safety of seed/animal stocks	decreased	☑	increased
Safety of land assets	decreased	☑	increased
Safety of communal assets	decreased	☑	increased

Other impacts (on-site)

Vegetable production	decreased	☑	increased

Comment:

Before SLM in one season and after in 2-3 seasons. Homestead access.

Off-site impacts

None



A local gardener and Tdh staff member discuss the keyhole garden pass-on and monitoring process (John Brogan).

Peer to peer pass-on approach with women (Bangladesh)

DESCRIPTION

Terre des hommes and Greendots introduced the "Peer to peer pass-on" system to enable womens' groups in Bangladesh to spread the "Keyhole garden" technique within their communities. The aim of the technique is to enable year-round homestead vegetable production despite the risk of flooding and tidal surges.

Keyhole gardens, a type of small, productive homestead vegetable garden based on Low External Input Sustainable Agriculture (LEISA) techniques, have been used in various African countries for over 15 years, and have shown that they can increase the availability of food and dietary diversity (FAO). They were developed by gardeners and small-scale farmers (with the support of Send a Cow UK) to suit different situations, such as the cold, dry winters of Lesotho, the small backyards of Rwanda, and the humid heat of central Uganda. To improve year-round homestead nutritional self-sufficiency for vulnerable families in South Asia (where rates of acute malnutrition in young children regularly cross emergency thresholds), keyhole gardens were adapted by Terre des hommes (Tdh) and Greendots to the conditions of river basin and coastal areas of Bangladesh (and eventually to India's Sundarbuns). As a component of Tdh's maternal neonatal and child health (MNCH) programme, the technology is intended to support year-round homestead gardening despite weather extremes (flooding, tidal surges, cyclones). To promote adoption of the keyhole gardening in the local communities, the programme initiated a "Peer to peer pass-on" system within 40 mothers' groups (having a total membership of nearly 800 women). Each mothers' group selected five representatives (200 women in total) to form a Garden Extension Group (GEG) and participate in the first round of training with the understanding that they would share knowledge with other women in the MNCH programme and the surrounding community. The project team trained each GEG in building gardens and LEISA small-scale agriculture techniques (including integrated composting, water retention, use of local materials, natural pest and disease control techniques and soil fertility measures, with proximity to the kitchen for optimal management and harvesting). GEG group members practiced garden construction by working together to build gardens at the homes of all five members. All 200 initial gardens were monitored by Tdh extension workers on a weekly basis. Tdh verified output, use and the capacity of gardens to withstand monsoon conditions, and the extent and effectiveness of the of the peer to peer pass-on experience.

LOCATION



Location: Kurigram municipality (Kurigram District), Patharghata Union (Barguna District), Kurigram District / Rajshahi Division and Barguna District/ Barisal Division, Bangladesh

Geo-reference of selected sites
- 89.64519, 25.8088

Initiation date: 2012

Year of termination: n.a

Type of Approach

- ☐ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based



Practicing together to build a keyhole garden (Peer to peer pass-on system) (S. Taylor).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The main aims of the approach are to involve women by building their capacity and peer network to replicate the keyhole gardening technology within their communities.

The main objective of the approach is that families, led by women 1) garden year-round with LEISA techniques, 2) increase the quantity and diversity of their homestead vegetable production and 3) verify that the DRR garden design reduces the consequences of flooding and tidal surges.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** Acceptance of womens' groups, existing mothers' groups within the health programme.
- **knowledge about SLM, access to technical support:** The Approach calls for capacity building on LEISA techniques (knowledge about SLM) via the Peer to peer pass-on system to spread the DRR-designed gardens.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (Homestead land users i.e. women):** Building the gardens: learning and eventually training their peers.
- **community-based organisations (Mothers' groups):** Garden extension groups to share the keyhole garden techniques within the scope of their maternal neonatal & child health activities.
- **SLM specialists/ agricultural advisers (Greendots):** Technical support with design of the approach: Daniel Varadi and Sheila Taylor. International organisation (Terre des hommes, an international NGO): Project implementing agency, direct connection with womens' groups within its MNCH Programme via Dr. Sultana Al-Amin (Gardening Specialist).

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation		✓			
planning		✓			
implementation					✓
monitoring/ evaluation				✓	

Specify who was involved and describe activities:

Comment: Terre des hommes and Greendots working through existing womens' MNCH nutrition groups, requested groups to nominate five women to receive the training.

Comment: As with all village-level activities, Terre des hommes works with a community volunteer in each village to plan the training and group interventions.

Comment: Once the women were trained, they were free to honour their commitments to train other women.

Comment: Self planning and monitoring tools were introduced to the women who decided whether to use them. Tdh provided monthly support visits to help interested women to update the planning and monitoring documents as needed, and to collect data.

Flow chart



Keyhole Garden Peer to Peer Pass-on System Approach—the Steps in a Nutshell

No material support (inputs) provided by Terre des hommes apart from training on Low External Input Sustainable Agriculture (LEISA) techniques and working with the community at the initial garden construction and technical training and monitoring support.

1. Selection of Groups:
↓
Tdh Health and Gardening teams collaborate to identify dynamic mothers' groups within Tdh's Health Programme in peri-urban & rural areas through a group questionnaire and prior knowledge of the women. (Start where there is the best chance of success.)

2. Choosing Garden Types
↓
Promote Keyhole gardens as the preferred Technology as they are potentially of greater benefit for production and dietary diversity. Some homesteads (peri-urban) are too small for Keyhole gardens. These families may opt for smaller "Bag gardens".

3. Selecting Extension Groups:
↓
Tdh teams meet women's groups and describe the gardens: their relevance to health & nutrition, and requirements to construct and maintain them. Group members confirm interest and select the five women to represent as the Garden Extension Group (GEG). The team will assess the GEG member homes to verify: 1) interest in gardening, 2) space to make the garden, 3) access to locally available resources needed to make the garden.

4. Training and Support:
↓
Each GEG is trained on building gardens and LEISA small scale agriculture techniques. The Tdh whole group practices garden construction by spending a day in each member's home and working together to build five gardens. LEISA sessions include integrated composting, water retention, use of local materials, natural pest and disease control techniques and soil fertility measures, and proximity to the kitchen for both harvesting and on-going garden management. LEISA posters on Keyhole garden construction, Liquid manure, plant tea, botanical pesticides distributed to each GEG member.

5. Monitoring the Progress
Seasonal Garden Planning and Planting Charts help the women to decide which crops are planted. Women also complete a simple Monitoring Chart to track the amount of produce they have grown, consumed, sold or gifted. Women keep both charts at home. During monthly visits, Tdh also collects data on 24-hour dietary recall, the spread of gardens to other households (as supported by GEG members); and 3) the existence of any new spontaneous copy gardens (not supported by GEG members). Tdh staff visit new gardens with the GEG members to provide advice and encouragement to the peers. Tdh facilitates monthly GEG meetings to collect information on garden progress, difficulties and new ideas. An External Evaluation and Learning Experience accompanies each project cycle.

Figure: Terre des Hommes.

Decision-making on the selection of SLM Technology

Decisions were taken by

- [ ] land users alone (self-initiative)
- [ ] mainly land users, supported by SLM specialists
- [ ] all relevant actors, as part of a participatory approach
- [x] mainly SLM specialists, following consultation with land users
- [ ] SLM specialists alone
- [ ] politicians/ leaders

Decisions were made based on

- [ ] evaluation of well-documented SLM knowledge (evidence-based decision-making)
- [ ] research findings
- [x] personal experience and opinions (undocumented)

Comment: The keyhole garden technique was introduced by Tdh, and went through informal adaptation and development with farmers and womens' groups so that the final design was chosen by the communities and reflected the construction.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- [x] Capacity building/ training
- [x] Advisory service
- [ ] Institution strengthening (organisational development)
- [x] Monitoring and evaluation
- [ ] Research

Capacity building/ training

Training was provided to the following stakeholders

- [x] land users
- [x] field staff/ advisers

Form of training

- [x] on-the-job
- [x] farmer-to-farmer
- [ ] demonstration areas
- [ ] public meetings
- [ ] courses

Subjects covered

n.a.

Advisory service

Advisory service was provided

- [x] on land users' fields
- [ ] at permanent centres

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [x] 2000-10000
- [ ] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Precise annual budget: n.a.

The following services or incentives have been provided to land users

n.a.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation?				✓
Did the Approach help land users to implement and maintain SLM Technologies?			✓	
Did the Approach improve coordination and cost-effective implementation of SLM?				✓
Did the Approach improve knowledge and capacities of land users to implement SLM?				✓
Did the Approach empower socially and economically disadvantaged groups?			✓	
Did the Approach improve gender equality and empower women and girls?				✓
Did the Approach lead to improved food security/ improved nutrition?			✓	
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters?				✓

Main motivation of land users to implement SLM

- [x] increased production
- [ ] increased profit(ability), improved cost-benefit-ratio
- [ ] reduced land degradation
- [x] reduced risk of disasters
- [ ] reduced workload
- [ ] payments/ subsidies
- [ ] rules and regulations (fines)/ enforcement
- [ ] prestige, social pressure/ social cohesion
- [ ] affiliation to movement/ project/ group/ networks
- [x] environmental consciousness
- [ ] customs and beliefs, morals
- [ ] enhanced SLM knowledge and skills
- [ ] aesthetic improvement
- [ ] conflict mitigation

Comment: Families reported growing in locations, and during a season, where it is not usually possible, and have better access to leafy vegetables even in a severe flood year. "On flat land the roots zone rots at this time of year, so we can't cultivate." Floods prevented families from growing anything last year. The plinth heights were adequate so that this year's floods did not hamper vegetables. The main benefit has been plants not rotting and being damaged as in previous flood years. No chemical fertilizers are needed and the keyhole garden vegetables taste better than vegetables from the markets.

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- [ ] no
- [x] yes
- [ ] uncertain

Comment: The gardens have no physical inputs from Tdh, and require low levels of external inputs from families thanks to use of local natural resources. The 'Farmer to farmer' or peer to peer pass-on learning system is the preferred method for dissemination, and favours group learning and working on garden planning, monitoring, construction and maintenance together. Once initiated during a project cycle, it does not require further resources to continue. The diversity of vegetables decreases the risk of total crop losses, increases opportunities for optimising nutrition and decreases the risk of recurrent malnutrition. Finally, the use of local seed banks, homestead seed production and seed sharing promotes crop genetic diversity. One woman described how a neighbour asked her to help build a keyhole garden; over the 4 to 5 months she has had it, two to three neighbours have expressed serious interest in the garden. Naturally, garden management requires weeding and other work; and because Tdh gives a low level of support she is doing it entirely herself.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Those who pass on their vegetables and skills are sometimes invited to share positive testimonials and participate in official events to further share the techniques.
- Skills and knowledge can be passed on not only to other women/farmers but also to local school students – who can in turn pass on new skills to their parents.
- One Send a Cow UK beneficiary described her happiness about being part of the "chain of giving" in her community.

Key resource person's view

- The underpinning ethos of this nutrition/gardening project is that it is developed and implemented using participatory processes.
- Beyond dissemination of technology, peer farmers have a greater emphasis on support and understanding principles of the different practices since the focus is on two-way communication.
- Local champions of the pass-on approach have returned to support implementing partner staff through training and extension work in other communities.
- Passing on can also help restore dignity and pride in smallholder farming communities and strengthen the social fabric.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Discontent could arise if the pace of outreach from peer pass-on system is slow while the interest is high (to receive training). For example, women could start to prepare materials to build gardens and get frustrated. → *Once the techniques to be shared have demonstrated success, the pass-on group should carefully plan and communicate the initiative for sharing the techniques to the wider community.*

Key resource person's view

- Replication and synergies with other projects and organisations must be continuously explored. → *Sharing experiences with local and regional Agricultural Extension authorities, potential partner organisations and other institutes active in SLM techniques.*

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Resource persons: John Brogan (john.brogan@tdh.ch) - SLM specialist, WASH/ DRR Advisor; Sheila Taylor (Sheila.Taylor@sendacow.org) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_784/
Linked SLM data: SLM Technology: Keyhole garden https://qcat.wocat.net/en/wocat/technologies/view/technologies_779/
Documentation was facilitated by: Terre des Hommes - Switzerland

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The Volunteer Farmer-Trainer Extension Approach: A User Guide. Technical Manual. Kirui J, et al., World Agroforestry Centre, 2016.:http://www.worldagroforestry.org/downloads/Publications/PDFS/TM16068.pdf

Links to relevant information which is available online

Send a Cow UK - Peer to Peer Pass on Approach: https://www.sendacow.org/the-pass-it-on-approach



Floating gardens in the wetlands for vegetable cultivation (Md. Zahid Hasan).

Floating garden (Bangladesh)

"Baira" or "Dhap"

DESCRIPTION

A floating garden is a traditional technology, practiced in the southern parts of Bangladesh, locally called "Baira" or "Dhap". The technology allows production of vegetables or seedlings in areas where farmland is scarce and where the land is flooded or waterlogged for more than six months in a year.

Floating gardens are a traditional practice in south-central districts of Bangladesh, and have been promoted by the government extension agency and development organisations in different parts of the country - with technical improvements. Under this technology, crops (mainly vegetables) are cultivated on floating garden beds in areas where the land is inundated for more than six months in a year. The basic raw material used to prepare a floating garden bed is the water hyacinth (*Eichhornia crassipes*). In some cases, bamboo stakes are also used to make the floating beds more robust and secure. Floating gardens are of different dimensions, with a standard size of 1.5 -1.8 metres wide, 10 -11 metres long and 1 - 1.3 metres high (i.e. above water level). However, dependent on the local situation - such as waves, the size of the water body, the presence of a wetland - the size may vary. It also depends on whether compost is added. The establishment of floating gardens is very cheap in terms of raw material and requires mainly manual labour for its establishment. There are no material costs for maintenance. The garden is used for two main purposes: for vegetable production and for vegetable seedling production. In permanently flooded areas, floating beds are mainly used for vegetable production. Almost any type of vegetables can be grown. Production of leafy vegetables has proved to be most profitable. However, all types of vegetable seedlings, and rice seedlings also, can be produced in floating gardens. In other areas, which are only inundated temporarily, floating gardens are used mainly for seedling production. In this second case, seedlings can be transferred from the floating gardens to fields on the mainland immediately after water recedes. This practice can save 2 to 3 weeks in vegetable or rice production in the winter season. This is a crucial advantage considering the trend towards shorter growing periods due to unpredictable spring rains. A key advantage of floating gardening is the fact that heavy rainfall usually has no negative impacts: thus, reducing risks and demonstrating climate resilience. Floating gardens can further contribute to food security and improved nutrition for poor households, and are a source of additional income by making use of cheap and abundant local inputs. Different NGOs have improved and promoted this technology in the northwest and northeast parts of Bangladesh since 2000. Since 2011, the public agricultural extension agencies have also promoted this technology. The overall goal is to protect people's assets for agricultural production from damage due to seasonal floods and to provide an option for alternative income. While resistant, floating gardens might not be robust enough for extreme events – minor repairs can be done by the owners themselves. In case of major damage, the beds can be replaced since investment costs are very low. In shallow areas, floating beds may become ordinary gardens during the dry season.

LOCATION



Location: Paschim Pagla, Patharia and Shimulbak unions under South Sunamganj sub-district, Charnarchar and Rajanagar unions under Derai sub-district, Sylhet division, Sunamganj district, Bangladesh

No. of Technology sites analysed:
2-10 sites

Geo-reference of selected sites
- 91.34291, 24.89298
- 91.33226, 24.82787

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: less than 10 years ago (recently)

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

HELVETAS Swiss Intercooperation



A floating garden in the initial stage with seedlings (Md. Zahid Hasan).



A floating garden with vegetables growing (Md. Zahid Hasan).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact
- ✓ improve household food security / nutrition

Comment: Floating gardens are prepared on a water body, hence can absorb sufficient water without additional irrigation.

Land use



Cropland - Annual cropping
Main crops (cash and food crops): Vegetables and seedlings



Waterways, waterbodies, wetlands - Swamps, wetlands
Main products/ services: Vegetable and Seedling

Water supply

- rainfed
- mixed rainfed-irrigated
- full irrigation
- ✓ post-flooding

Number of growing seasons per year: 2
Land use before implementation of the Technology: earlier these wetland areas were mainly fallow (not used for any productive purpose). During the monsoon season, the waterbodies are used for fishing by local farmers including the landless poor. Water hyacinth in these wetlands were partially used as fodder, though most of it decomposed naturally without use.
Livestock density: n.a.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- ✓ adapt to land degradation
- not applicable

Comment: The technology is used to adapt to natural seasonal flooding, to prevent damages by floods by using wet lands for crop production.

Degradation addressed



water degradation - Hs: change in quantity of surface water

Comment: more frequent and severe seasonal flooding.

SLM group

- improved ground/ vegetation cover
- wetland protection/ management
- home gardens

SLM measures



agronomic measures - A5: Seed management, improved varieties



structural measures - S11: Others



management measures - M1: Change of land use type

TECHNICAL DRAWING

Technical specifications

Dimensions: The floating beds are of different sizes. The standard size at the time of preparation is 1.5 - 1.8 metres wide, 10-11 metres long and 1.0-1.3 metres height.

– Floating beds should not cover more than 30% of the respective water body (wetland area) in order to maintain the environment for other aquatic resources (e.g. fish).

– Construction material used: The main material for the preparation of the floating garden are water hyacinths (Eichhornia crassipes). In some cases, bamboo sticks are also used to increase its resistance. If available, compost may be applied to the beds.

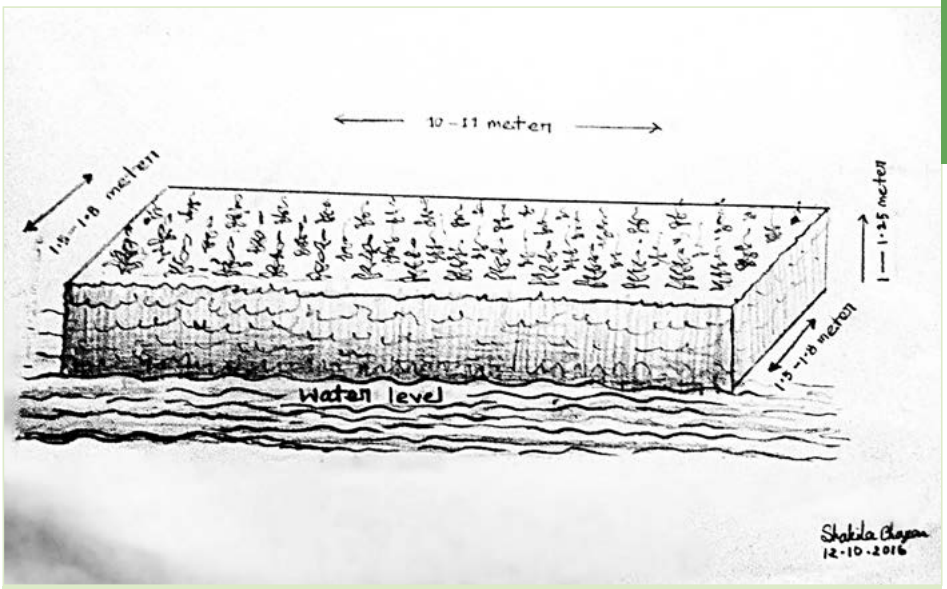

Figure: Shakila Chayan

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1 decimal for 5 floating beds; 1 hectare = 247 decimals)**
- Currency used for cost calculation: **BDT Bangladesh Taka**
- Exchange rate (to USD): 1 USD = 78 BDT
- Average wage cost of hired labour per day: 1 person-day = BDT 300 (USD 3.85).

Most important factors affecting the costs

In case the inputs, mainly water hyacinth, are not available at the selected sites, this increases the costs for hyacinths to be transported from distant locations. All indicated costs are annual since the beds need to be reestablished every year.

Establishment activities

1. Bed preparation (by hired labour) (Structural; August-September)
2. Seeding, care and maintenance, harvesting (Agronomic)

After full harvesting of vegetable in March, the bed (decomposed water hyacinth) can be used as organic compost for other crops in cultivable land.

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Hired labour cost for bed establishment	person day	10.0	300	3000	100
Bed management cost (seeding, care, harvest etc.)	person day	90.0	300	27000	100
Plant material					
Seeds per year	pieces	25.0	100	2500	
Construction material					
Bamboo	bamboo quantity	2.0	100	200	
Rope and lubricants	lumpsum	1.0	250	250	
Total costs for establishment of the Technology				**32950 Taka**	

Maintenance inputs and costs

No maintenance required.

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [ ] 2001-3000 mm
- [x] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 3365.0
The driest month is December, with 6 mm of rain. The greatest amount of precipitation occurs in June, with an average of 712 mm.
Name of the meteorological station: Sunamganj, Bangladesh (data source: www.en.climate-data.org)
The average annual temperature is 25.0 °C in Sunamganj.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [ ] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [x] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [x] concave situations
- [ ] not relevant

Groundwater table
- [x] on surface
- [ ] < 5 m
- [ ] 5-50 m
- [ ] > 50 m

Availability of surface water
- [x] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [x] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [x] yes
- [ ] no

Comment: Each year seasonal monsoon flooding. However, early flash (pre monsoon flood) occurs only every 3 years.

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

Comment: Water bodies are rich with diverse aquatic organisms.

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [ ] less than 10% of all income
- [x] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [x] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [ ] individual, not titled
- [ ] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [ ] individual

Water use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [ ] leased
- [x] individual

Comment: The farmers established floating gardens in public water bodies as well as private water bodies (with agreement of owners).

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

crop production	decreased	increased	**Comment:** Crop production during floods in the rainy season becomes possible.
production area (new land under cultivation/ use)	decreased	increased	**Comment:** Water bodies can be used for food production.
farm income	decreased	increased	**Comment:** People produce vegetable/ seedlings and increase their cash income through selling of surplus in the market. It also provides food and additional nutrition support to the family. Consequently, poor farmer families increase their resilience to food insecurity and income fluctuations.
diversity of income source	decreased	increased	**Comment:** Additional income for floating gardeners, which is particularly valuable for the poor - i.e. landless people.
workload	increased	decreased	**Comment:** Slight but no significant increase in workload for bed preparation, care and harvesting.
economic disparities	increased	decreased	

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved	**Comment:** Vegatable production for home consuption contributes to household food security, which is particularly critical during the rainy season.
health situation	worsened	improved	**Comment:** Improved nutrition through household consumption of own vegetables.
land use/ water rights	worsened	improved	**Comment:** People established floating gardens on public water bodies or individual water bodies, based on (verbal) agreement and regulated by a fee or rent.
cultural opportunities (eg spiritual, aesthetic, others)	reduced	improved	**Comment:** Increase aesthetic aspect of wetlands; water becomes a valuable productive surface with plants and flowers.
SLM/ land degradation knowledge	reduced	improved	**Comment:** Increase knowledge about Disaster Risk Reduction technology, based on local resources and capacities adjusted to the situation of socially and economically disadvantaged groups.
situation of socially and economically disadvantaged groups (gender, age, status, ehtnicity etc.)	worsened	improved	**Comment:** It is a simple 'self-help' technology, which provides new income options particularly for the most vulnerable. It can be replicated by among the poor and very poor community members.

Ecological impacts

vegetation cover	decreased	increased	**Comment:** Floating gardens increase vegetation coverage on the water surface.
biomass/ above ground C	decreased	increased	**Comment:** The residues of old floating gardens, usually at th end of the rainy season, are used as compost/ fertilizer for crop land.
animal diversity	decreased	increased	**Comment:** With the floating gardens there is less water hyacinth cover over the surface, which increases sunlight and oxygen in the water. Hence, this contributes to good conditions for the growth of fish and other aquatic resources.
flood impact	increased	decreased	**Comment:** Negative impacts due to floods, such as damage and limited production can be substantially reduced with this technology, which increases production and income during flooding period.

Off-site impacts

damage by wave erosion	increased	reduced	**Comment:** The floating gardens reduce wave erosion on neighbours' fields, since beds protect adjacent land assets from soil erosion.
damage on neighbour's fields	increased	reduced	**Comment:** Reduction of wave action and soil erosion of the adjacent/ raised land.

Benefits compared with establishment costs

Short-term returns	very negative	very positive
Long-term returns	very negative	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Climate-related extremes (disasters)

general (river) flood	not well at all	very well
flash food	not well at all	very well
other	not well at all	very well

Comment: Increasingly unpredictable start and duration of monsoon/rainy season, floods.

Other Climate-related consequences

extended growing period	not well at all	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- [ ] single cases/ experimental
- [x] 1-10%
- [ ] 10-50%
- [ ] more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- [ ] 0-10%
- [x] 10-50%
- [ ] 50-90%
- [ ] 90-100%

Number of households and/ or area covered

About 1000.

Has the Technology been modified recently to adapt to changing conditions?

- [ ] Yes
- [x] No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- In the Haor area (local wetland ecosystem flooded during monsoon season) water hyacinths are naturally abundant. These are the basis and substrate for floating gardens. Hence, the technology makes use of local plants as resources. If required, floating beds can easily moved from one location to another. After preparation of the bed, no additional labour is required.
- There is hardly any pest infestation, therefore no use of pesticides is required.
- After the final harvest, the beds are used as organic compost for the fields. Further, the farmers either sell or use the residues as compost.
- This simple technology can easily be replicated.
- During heavy rainfalls and storms, the crops are not damaged by floods since they are on a floating surface.

Key resource person's view

- Through this technology, crops can be produced on the water surface. The usually abundant water hyacinth are used as a productive resource, which increases the surface for crop production. In contexts, such as Bangladesh, where land resources are scarce this opens up production options in abundant water bodies for landless farmers, who can earn money within a short period and with little investment.
- The production for home consumption improves nutrition, contributes to food security and the surplus is sold at the market, which contributes to the income of poor households.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- In some cases there are water leeches. Therefore, people become afraid of preparing floating beds. → *People smear diesel/ kerosene oil in their bodies before preparation of floating beds to protect them from attack of leeches.*
- In some cases, water hyacinths are not available locally. Further challenges are the guarding/ security of the gardens, and the time consumed in establishment of the beds. → *Introduce and prepare floating gardens by supporting whole groups instead of individual famers.*
- Wave action and local streams may cause the floating beds to drift away. → *Use bamboo poles to fix floating beds.*

Key resource person's view

- Non-availability of adequate water hyacinth in same place every year. → *Prepare beds in the places where water hyacinths are available and then move the beds to the desired locations.*
- Due to heavy wave action or heavy water flow, floating beds may be broken/ destroyed. → *Prepare small beds.*
- Lack of awareness and willingness of farmers to practice this technology. → *Organise meetings, training, demonstrations, and learning visit.*

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Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		✓	✓	✓	
Wave Action		✓	✓	✓	
Convective storm		✓	✓	✓	
Fog		✓			
Biological hazards					
None					
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

				Comment:
Exposure				
of people	very high/ strong	✓	very low/ non-existent	
of private assets	very high/ strong	✓	very low/ non-existent	*Most people lost standing rice due to flash floods.*
of community land	very high/ strong	✓	very low/ non-existent	
of community infrastructure	very high/ strong	✓	very low/ non-existent	*Damage of flood protection embankment.*
Economic factors				
Access to markets	very high/ strong	✓	very low/ non-existent	*Poor market infrastructure due to remoteness.*
Income	very high/ strong	✓	very low/ non-existent	*Significant reduction of livelihoods options during flood.*
Diversification of income	very high/ strong	✓	very low/ non-existent	*Limited options of income especially for poor landless farmers.*
Savings/stocks	very high/ strong	✓	very low/ non-existent	*Due to limited income options.*
Bank savings/remittances	very high/ strong	✓	very low/ non-existent	*Limited opportunities and access.*
Degree insurance coverage	very high/ strong	✓	very low/ non-existent	*No insurance coverage.*
Social factors				
Literacy rate	very high/ strong	✓	very low/ non-existent	*Significantly less than national average.*
Government support	very high/ strong	✓	very low/ non-existent	*Lack of human and physical resource, difficult communication due to land scape.*
Family support	very high/ strong	✓	very low/ non-existent	*Insufficient resources and capacity.*
Community support	very high/ strong	✓	very low/ non-existent	*Weak social capita.l*
Access to public services	very high/ strong	✓	very low/ non-existent	*Difficult and expensive communication; lack of accountability of public system.*
Physical factors				
Robustness of houses	very high/ strong	✓	very low/ non-existent	*Houses by low quality building materials*
Robustness of infrastructure	very high/ strong	✓	very low/ non-existent	*Poor construction materials and remain exposed to extreme weather (rain, flood, storm etc.) for several months.*
Homestead	very high/ strong	✓	very low/ non-existent	*Limited space in homestead during flood.*
Other vulnerability factors				
Rice crop	very high/ strong	✓	very low/ non-existent	*Boro rice is the major cash crop in the locality, frequently damaged by flash flood.*
Access to land	very high/ strong	✓	very low/ non-existent	*Scarce land resources, high proportion of landless people.*

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- [ ] substantial increase in losses
- [x] some increase in losses
- [ ] no change
- [ ] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1	[ ] 1
[ ] 2-5	[ ] 2-5
[ ] 6-10	[ ] 6-10
[ ] 11-50	[ ] 11-50
[x] > 50	[x] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[ ] 11-50	[ ] 11-50
[ ] 51-100	[ ] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[x] > 500	[x] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[x] 51-80%	[ ] 51-80%
[ ] 80-100%	[x] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[x] 51-80%	[ ] 51-80%
[ ] 80-100%	[x] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[x] 0 USD	[x] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[ ] 1001-5000 USD	[ ] 1001-5000 USD
[ ] 5001-10’000 USD	[ ] 5001-10’000 USD
[ ] 10’001-50’000 USD	[ ] 10’001-50’000 USD
[ ] 50’000-250’000 USD	[ ] 50’000-250’000 USD
[ ] > 250’000 USD	[ ] > 250’000 USD

Duration since last disaster

- [ ] < 3 months
- [ ] 3-6 months
- [x] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Technology

This technology aims at protecting people’s assets for agricultural production from damages due to seasonal floods and provide options for alternative income resources. The floating garden technology is designed as a measure to protect effectively from yearly floods. It might not be robust enough for extreme events with heavy storms and waves. The owners can do themselves smaller repairing. In case of mayor damages the beds can be replaced by new ones, since the investment costs are very low.

IMPACTS

Additional benefits of the Technology

Safety (on-site)			**Comment:**
None			
Economic goods (on-site)			
Safety of land assets	decreased	increased	*Before SLM 0, now 1000 floating gardens. Comparison of available land during floods before the introduction of the floating gardens flooded land was unused/abandoned.*
Safety of communal assets	decreased	increased	
Other impacts (on-site)			
Vegetable production	decreased	increased	*Abundant water body used for crop production.*
Seedling production	decreased	increased	*Increased winter vegetable production.*
Other	decreased	increased	*Use of old beds as fertilizer/ compos.t*
Off-site impacts			
options for landless/most vulnerable groups	reduced	improved	*Option of agricultural production and access to market for landless (usually poor and most vulnerable groups.)*



Millet variety HKP at the grain filling stage (Moutari Elhadji).

Improved pearl millet variety HKP (Niger)

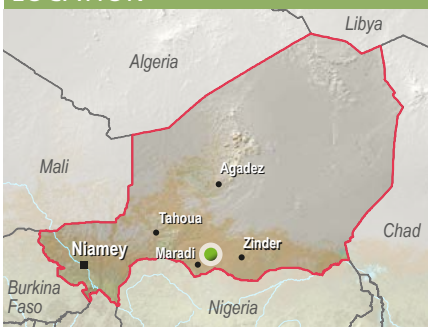
Yada irin hatsi mai nagarta HKP cikin jahar Mayahi

DESCRIPTION

The pearl millet variety HKP, "Haini Kire Précoce" in the Djerma language, is a high-yielding, drought resistant variety, adapted to the Sahelian context.

As in all of Niger, the department of Mayahi in the southern central part of the country is characterised by a harsh natural environment with low precipitation, which is variable in space and time. Temperatures are high with a tendency to rise even more due to the effects of climate change. At 3,1%, the population growth rate is very high. The pressure on the natural resources has also increased, and chronic food insecurity regularly affects the majority of the population. Millet and cowpeas are the main agricultural products of the region, but due to demographic pressure, the available arable land is almost entirely in use. Consequently, food security can only be achieved through an increased production. Pearl millet (*Pennisetum glaucum (L.) R.Br*) is grown in several countries in West Africa, including Niger, Nigeria and Burkina Faso. Millet is the most cultivated and consumed cereal grain in Niger, while its stover is eaten by livestock and also serves as construction material for houses. The millet variety HPK was developed in 1978 by the National Agronomic Research Institute of Niger (INRAN) with the aim of producing a better performing variety, more adapted to the Sahelian context. HKP is resistant to drought, not very sensitive to worms, slightly sensitive to the photoperiod, but is however sensitive to smut and mildew. Nevertheless, this productive variety is not widely grown. The delay in dissemination is explained by difficulties in the technical management of the seed system in Niger, and the problems of access to send by local producers. Yet, in the past ten years, a significant advance has been noted in the adoption of improved seed by farmers who have become aware that the reality of climate change requires better performing varieties. The agro-ecological zone suited to HPK is between the 350 and 800 mm isohyets. It can be cultivated as a monoculture, or in association with other crops like cowpeas, sorghum, or peanuts. The crop cycle takes between 75 and 90 days. Millet is preferably grown on light soils rich in organic matter. The preparation of the seedbed requires an amendment of 3 to 5 tons of decomposed organic matter per hectare and scarification with a Canadian cultivator (3 or 5 blades) after the first rains to bury the organic matter. The best period for sowing is June. Ten kilos of seed are required to sow one hectare. The spacing for the seeds is 1 m x 1 m between the pockets and the lines, or 10.000 pockets per hectare. The seed can be combined with a micro-dose of mineral fertiliser of 6 g/pocket (60 kg/ha) for the 15-15-15 fertiliser and 2 g/pocket (20 kg/ha) for the DAP. The field maintenance activities must be done in time. These include two operations of weeding and harrowing ('sarclo-binage'), while thinning out until three plants per pocket in the first operation, two weeks after seeding at the latest; the second operation of weeding and harrowing is two or three weeks after the first. A cover of urea manure is applied two times on the pocket (for the southern zone: 50 kg/ha in the tillering phase and 50 kg/ha at stem formation; for the intermediate zone: 25 kg/ha in the tillering phase and 25 kg/ha at stem formation). One or two treatments are expected in case of mildew. If unsuccessful, the plants affected by the mildew and the leaf miner must be removed, burnt and buried into the soil. The harvest is carried out when the ears are completely mature and dry. The variety HKP has a potential yield of 1,5 to 2,5 tons per hectare. The millet can be conserved in a granary or in a bag after treshing. The producers appreciate the good emergence of the crop, its drought resistance, earliness and its yield.

LOCATION



Location: Mayayi, Maradi, Niger

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 7.67227, 13.95748

Spread of the Technology: evenly spread over an area (approx. < 0.1 km² (10 ha))

Date of implementation: 2014

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- ✓ during experiments/ research
- ✓ through projects/ external interventions



A producer in a field with millet at the tillering stage (Rabo Issaka Salissou).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
- ✓ reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- reduce risk of disasters
- ✓ adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use



Cropland - Annual cropping
Main crops (cash and food crops): Millet, sorghum, cowpea, groundnut, sesame, nut grass

Water supply

- ✓ rainfed
- mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 1
Livestock density: n.a.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
- restore/ rehabilitate severely degraded land
- ✓ adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wt: loss of topsoil/ surface erosion



chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)



biological degradation - Bp: increase of pests/ diseases, loss of predators

Comment: Wt: Through ploughing, the rate of surface runoff is reduced or even eliminated.
Cn: The application of organic manure, mineral fertilizer or compost improves soil fertility.
Bp: Slightly sensitive to smut and mildew.

SLM group

- improved plant varieties/ animal breeds

SLM measures



agronomic measures - A2: Organic matter/ soil fertility, A5: Seed management, improved varieties

TECHNICAL DRAWING

Technical specifications

The spacing of the seeds is 1 m x 1 m between the pockets and between the lines, or 30000 plants per ha.
The height of the crop at maturity varies from 190 to 200 cm.
The length of the ear varies from 50 to 70 cm.



Salissou Rabo Issata

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology area (size and area unit: **1 ha**)
  Currency used for cost calculation: **CFA franc**
  Exchange rate (to USD): 1 USD = 617 CFA.
  Average wage cost of hired labour per day: 1250 CFA francs per person-day.

Most important factors affecting the costs

Fertiliser and biocides.

Comment: The cost of equipment was not assessed because this is included in the labour costs. In the agricultural custom of this zone a worker brings his own work tool.

Establishment activities

Soil preparation (Agronomic; May)
1. Seeding (Agronomic)
2. First weeding (Agronomic)
3. Thinning plants (Agronomic)
4. Second weeding (Agronomic)
5. Harvest (Agronomic)
6. Transport (Management)
7. Storage (Management)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
From soil preparation to storage	person days	22.5	1250	28125	100
Plant material					
Seed	kg	10.0	300	3000	
Fertilizers and biocides					
Fungicide	g	40.0	25	1000	
Organic manure	t	5.0	1600	8000	100
NPK	kg	60.0	300	18000	100
Urea	kg	50.0	300	15000	100
Total costs for establishment of the Technology				**73125 CFA**	

NATURAL ENVIRONMENT

Average annual rainfall
- ✓ < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1000 mm
- 1001-1500 mm
- 1501-2000 mm
- 2001-3000 mm
- 3001-4000 mm
- > 4000 mm

Agro-climatic zone
- humid
- sub-humid
- ✓ semi-arid
- arid

Specifications on climate
Average annual rainfall in mm: 250.0
The rainy season lasts 3 to 4 months from June to September.
Name of the meteorological station: Mayahi

Slope
- ✓ flat (0-2%)
- gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- steep (31-60%)
- very steep (>60%)

Landform
- ✓ plateau/ plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Altitude
- 0-100 m a.s.l.
- ✓ 101-500 m a.s.l.
- 501-1000 m a.s.l.
- 1001-1500 m a.s.l.
- 1501-2000 m a.s.l.
- 2001-2500 m a.s.l.
- 2501-3000 m a.s.l.
- 3001-4000 m a.s.l.
- > 4000 m a.s.l.

Technology is applied in
- convex situations
- concave situations
- ✓ not relevant

Soil depth
- ✓ very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

Soil texture (topsoil)
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Topsoil organic matter content
- high (>3%)
- medium (1-3%)
- ✓ low (<1%)

Groundwater table
- on surface
- < 5 m
- ✓ 5-50 m
- > 50 m

Availability of surface water
- excess
- good
- medium
- ✓ poor/ none

Water quality (untreated)
- good drinking water
- ✓ poor drinking water (treatment required)
- fine/ heavy (clay)
- for agricultural use only (irrigation)
- unusable

Is salinity a problem?
- yes
- ✓ no

Occurrence of flooding
- yes
- ✓ no

Species diversity
- high
- medium
- ✓ low

Habitat diversity
- high
- medium
- ✓ low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- subsistence (self-supply)
- ✓ mixed (subsistence/ commercial
- commercial/ market

Off-farm income
- ✓ less than 10% of all income
- 10-50% of all income
- > 50% of all income

Relative level of wealth
- ✓ very poor
- ✓ poor
- average
- rich
- very rich

Level of mechanisation
- ✓ manual work
- animal traction
- mechanised/ motorised

Sedentary or nomadic
- ✓ Sedentary
- Semi-nomadic
- Nomadic

Individuals or groups
- ✓ individual/ household
- groups/ community
- cooperative
- employee (company, government)

Gender
- ✓ women
- ✓ men

Age
- children
- ✓ youth
- ✓ middle-aged
- elderly

Area used per household
- < 0.5 ha
- 0.5-1 ha
- ✓ 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1000 ha
- 1000-10000 ha
- > 10000 ha

Scale
- small-scale
- ✓ medium-scale
- large-scale

Land ownership
- state
- company
- communal/ village group
- ✓ individual, not titled
- individual, titled

Land use rights
- open access (unorganised)
- communal (organised)
- leased
- ✓ individual

Water use rights
- open access (unorganised)
- ✓ communal (organised)
- leased
- individual

Access to services and infrastructure

health	poor ✓	good
education	poor ✓	good
technical assistance	poor ✓	good
employment (e.g. off-farm)	poor ✓	good
markets	poor ✓	good
energy	poor ✓	good
roads and transport	poor ✓	good
drinking water and sanitation	poor ✓	good
financial services	poor ✓	good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

crop production	decreased	increased ✓	**Before SLM:** 260 kg/ha **After SLM:** 680 kg/ha **Comment:** Agricultural production is increased by more than 250%.
farm income	decreased ✓	increased	**Comment:** The millet is intended for home consumption and not for the market.

Socio-cultural impacts

food security/ self-sufficiency	reduced	improved ✓	**Before SLM:** Covering 3 months of food requirements. **After SLM:** Covering 9 months of food requirements. **Comment:** The yield obtained is exclusively intended for home consumption. Therefore three quarters of the annual requirement can now be met.
SLM/ land degradation knowledge	reduced	improved ✓	**Before SLM:** Limited **After SLM:** Knowledge sharing. **Comment:** Before the SLM, the knowledge of the producer was limited, whereas with the SLM the producer acquires other experiences.

Ecological impacts

drought impacts	increased	decreased ✓	**Comment:** The millet variety HKP is more resistant to drought.

Benefits compared with establishment costs

Short-term returns	very negative	very positive ✓
Long-term returns	very negative	very positive ✓

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

seasonal temperature increase	not well at all	very well ✓	Season: dry season **Comment:** increase of extreme precipitation, variations between the seasons.
variability	not well at all	very well ✓	

Climate-related extremes (disasters)

drought	not well at all	very well ✓

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- ✓ 10-50%
- more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- 0-10%
- ✓ 10-50%
- 50-90%
- 90-100%

Number of households and/ or area covered

103 ha sown with HKP in Maitsakoni during the cropping season of 2016.

Has the Technology been modified recently to adapt to changing conditions?

- Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view
- High yield.
- Resistance to drought
- Adapted to the soil in the zone.

Weaknesses/ disadvantages/ risks → *how to overcome*

Key resource person's view
- Sensitive to smut and mildew and insect attack. → *Pulling out infected plant Phytosanitary treatment.*

REFERENCES

Compiler: Judith Macchi - judith.macchi@heks.ch
Resource persons: Baoua Ibrahim (baoua.ibrahim@yahoo.fr) - SLM specialist; Anné Souley - land user; Sabo Sani - land user;
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/ technologies_661/
Linked SLM data: SLM Approach: Training and awareness raising in the use of improved agricultural techniques https://qcat.wocat.net/en/wocat/approaches/view/ approaches_680/
Documentation was facilitated by: HEKS (Hilfswerk der evangelischen Kirchen Schweiz) - Switzerland

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Drought		☑			
Wildfire		☑			
Biological hazards					
Epidemic (human)		☑			
Parasites (vegetation)	☑				
Man-made hazards					
None					

Vulnerability – capacity profile of the site before the Technology was applied

Exposure			
of people	very high/ strong	☑	very low/ non-existent
of community land	very high/ strong	☑	very low/ non-existent
Economic factors			
Income	very high/ strong	☑	very low/ non-existent
Diversification of income	very high/ strong	☑	very low/ non-existent
Social factors			
Literacy rate	very high/ strong	☑	very low/ non-existent
Government support	very high/ strong	☑	very low/ non-existent
Family support	very high/ strong	☑	very low/ non-existent
Community support	very high/ strong	☑	very low/ non-existent
Access to public services	very high/ strong	☑	very low/ non-existent
Physical factors			
Robustness of houses	very high/ strong	☑	very low/ non-existent
Robustness of infrastructure	very high/ strong	☑	very low/ non-existent

Damage and losses situation at the Technology sites

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- ☐ some increase in losses
- ☐ no change
- ☑ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☑ 0	☑ 0
☐ 1	☐ 1
☐ 2-5	☐ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☑ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☑ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☐ > 500	☐ > 500

% of land destroyed by disasters

over the last 5 years

- [ ] 0% (no damage)
- [ ] 1-20%
- [ ] 21-50%
- [ ] 51-80%
- [ ] 80-100%

over the last 15 years

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% of land affected by disasters

over the last 5 years

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- [ ] 21-50%
- [x] 51-80%
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over the last 15 years

- [ ] 0% (no damage)
- [x] 1-20%
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- [ ] 51-80%
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Damage sum (in USD) caused by disasters

over the last 5 years

- [ ] 0 USD
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- [ ] 1001-5000 USD
- [x] 5001-10'000 USD
- [ ] 10'001-50'000 USD
- [ ] 50'000-250'000 USD
- [ ] > 250'000 USD

over the last 15 years

- [ ] 0 USD
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- [ ] 1001-5000 USD
- [ ] 5001-10'000 USD
- [x] 10'001-50'000 USD
- [ ] 50'000-250'000 USD
- [ ] > 250'000 USD

Duration since last disaster

- [ ] < 3 months
- [ ] 3-6 months
- [ ] 7-12 months
- [ ] 1-2 years
- [x] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Technology

Production must be protected through protection against insect pests and land conflict.

IMPACTS

Additional benefits of the Technology

Safety (on-site)

None — decreased — increased

Economic goods (on-site)

Safety of seed/animal stocks — decreased — increased

Other impacts (on-site)

None

Off-site impacts

None



Training of producers in post-harvest management (SahelBio).

Training and awareness-raising in the use of improved agricultural techniques (Niger)

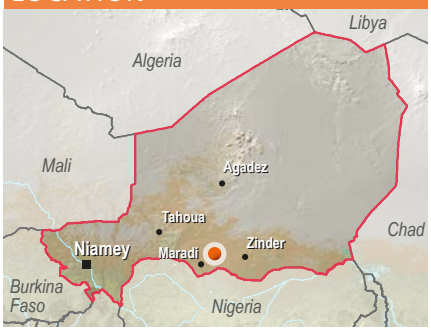
Horon karama jouna sani daziyara dakouma sallar kofofi budé

DESCRIPTION

This approach consists of disseminating improved agricultural techniques to increase agricultural production. Land users are trained, and demonstration events are organised to make others aware of these improved techniques.

This is a project to train land users or 'producers' and to make them aware of agroecological intensification. Demonstration plots are used to show various techniques including: (a) improved land clearing, (b) the use of better varieties of millet and cowpeas, (c) the use of mono-cropping and strip cropping, (d) integrated water and soil fertility management using the 'zaï technique' (wide and deep planting holes with localised input of organic manure), (e) the management of insect pests through biological control, (f) the use of bio-pesticide from neem seed, and (g) post-harvest protection techniques without pesticides. These proven techniques can contribute to food security through yield increases of at least 50%. Animal feeding has also been intensified by the establishment of three community production units and the selling of multi-nutritional fodder blocks - these are a concentrate of nutritious ingredients prepared from crop residues such as stalks and pods. The approach used is participatory, because it initially consists of identifying the needs of the producers. It enables the involvement of all stakeholders (researchers-extension workers-producers), and then strengthens the connections between them as well as building their capacities through exchange and training. This approach is combined with open days, which are organised at regular intervals to present new and relevant technologies. The land users appreciate being involved in solving their own problems. The implementation of the project started with a kick-off meeting involving the entire project team, farmer organisations at the village level, community leaders and the technical services. All the activities of the project were presented and proposals were made for the responsibilities of each of the partners. These were as follows: (a) the team takes charge of the programming, and the monitoring and the evaluation of the activities at the village level; (b) each extension worker is charged with managing the activities of 20 villages; (c) the technical service for agriculture takes charge of supervising agricultural activities, is involved in the selection of the producers, the technical training, and in the assistance and advice to producers in the application of the technologies and the assessment of yields; (d) the technical service for livestock farming takes charge of technical advice and monitoring of the private production units of the multi-nutritional fodder blocks for livestock; it is also involved in awareness-raising of livestock farmers about animal feeding and the use of the fodder blocks; (e) the farmers' organisations in the villages are involved in the implementation of the activities by the establishment of a management committee.

LOCATION



Location: Mayahi, Maradi, Niger

Geo-reference of selected sites
- 7.67235, 13.95757

Initiation date: 2014

Year of termination: n.a.

Type of Approach
- traditional/ indigenous
- recent local initiative/ innovative
- ✓ project/ programme based



Training of producers on the management of insect pests of millet and cowpeas (Rabé Mahamane Moctar).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Increase the utilisation rate of improved varieties adapted to the agricultural context of the intervention zone.
Establish demonstration units for promising agricultural technologies that increase the yields of millet and cowpeas.
Strengthen the capacity of the producers to use techniques for the use of agricultural by-products in animal feeding.
Involve producers in decision-making and the solving of problems that concern them.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The land users/ producers are open to innovation and are involved in the decision-making processes that concern them.
- **collaboration/ coordination of actors:** All stakeholders are involved.
- **policies:** The public authorities facilitate the activities.
- **knowledge about SLM, access to technical support:** The technical fact sheets assist the producers to understand and implement the technology.
- **markets (to purchase inputs, sell products) and prices:** Collective marketing helps producers to obtain a greater farm income.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **availability/ access to financial resources and services:** Financial resources are limited, which constrains the investment potential of producers.
- **workload, availability of manpower:** The workload is high, especially for the zaï technique.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (producers, both men and women):** Provide land and organic manure. Collect neem seed required for the local production of bio-pesticide. Labour for farming operations, including soil and water conservation structures.
- **community-based organisations (Farmers' organisations):** Provide premises for the production units for the mulitnutritional fodder blocks for livestock (MNFB). Purchase of raw materials.
- **SLM specialists/ agricultural advisers (Field officers, agronomic engineers):** Training of the producers.
- **researchers (Researchers from the university of Dan Dicko Dankoulodo of Maradi and the INRAN (National Agronomic Research Institute in Niger)):** Training of the field officers. Evaluation of the project activities.
- **NGO (Sahel Bio: research agency financed by the HEKS to support food security by agro-ecological intensification in the department of Mayahi):** Coordination, financing of seed, small agricultural equipment such as planting equipment, bio-pesticides and ichneumon fly (a parasitic wasp) for biological pest control.
- **local government (Prefect and mayors):** Monitoring the project activities.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation				✓	
monitoring/ evaluation				✓	

Specify who was involved and describe activities

The local land users were consulted by the project team in the initiation phase.

A kick-off meeting gathered the entire project team, the farmers' organisations at the village level, the community officials and the technical services. The project activities were shared and the responsibilities of each of the partners were made explicit.

The producers provide the land and the organic manure. They collect the neem seed required for the production of the biopesticide, and undertake all the labour for the field operations.

The project team, in collaboration with the producers has accepted responsibility for the monitoring of activities in the villages. An external consultant was hired to evaluate the project.

Flow chart

The project is in charge of the programming, monitoring and evaluation of the activities at the village level. The technical services take care of the supervision and the monitoring of the supported activities. A contract is signed with consultants for the training of the producers. Another contract is signed with the community radio stations to disseminate knowledge about the technologies to villages in the department which are covered by the radio. The coordinating village unit is drawn from existing farmers' organisations in the villages which are involved in the implementation of the activities. It is composed of a committee made up by two persons per village: a man and a women who will be charged with the monitoring of the activities. They will assist the project team in the selection of the producers.

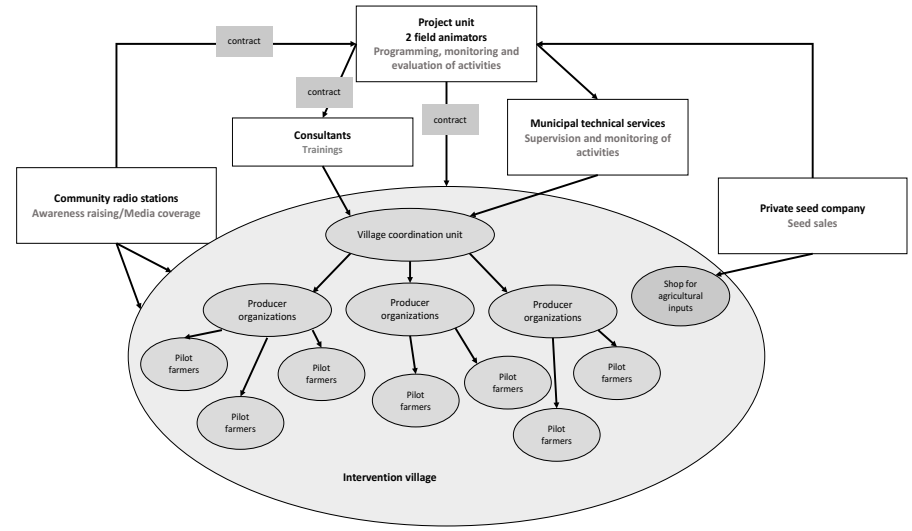


Figure: Baoua Ibrahim, Project coordinator

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- evaluation of well-documented SLM knowledge (evidence-based decision-making)
- ✓ research findings
- personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- ✓ Research

Capacity building/ training

Training was provided to the following stakeholders

- ✓ land users
- ✓ field staff/ advisers

Form of training

- on-the-job
- ✓ farmer-to-farmer
- ✓ demonstration areas
- ✓ public meetings
- courses

Subjects covered

Training producers on the roadmap of technologies.
Training on techniques for water management and soil fertility management.
Training on pest management.
Training on improved storage of harvests.

Advisory service

Advisory service was provided
- ✓ on land users' fields
- ✓ at permanent centres

Comment: An advisory service is provided at the request of land users, or during the diagnostic survey. The advisory service centres are supervised by the department of agriculture.

Research

Research treated the following topics
- ✓ sociology
- economics/ marketing
- ecology
- ✓ technology

Comment: The project team, consisting of researchers of the University of Maradi and of the National Agronomic Research Institute (INRAN/ MARADI), works actively on the impact of the technologies on the land users, as well as on the factors determining the adoption of the technology.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component
- < 2000
- 2000-10000
- ✓ 10000-100000
- 100000-1000000
- > 1000000

Major donor: HEKS/EPR

Precise annual budget: n.a.

The following services or incentives have been provided to land users
- ✓ Financial/ material support provided to land users
- ✓ Subsidies for specific inputs
- Credit
- ✓ Other incentives or instruments

Financial/ material support provided to land users
The project provided the seed of cowpea (IT90k372-1-2) and millet (HKP), minor agricultural equipment such as small agricultural equipment such as planting equipment, bio-pesticides and ichneumon fly for biological pest control.

Subsidies for specific inputs (including labour)

Labour by land users was
- ✓ voluntary
- food-for-work
- paid in cash
- rewarded with other material support

	partly financed	fully financed
equipment: tools *Row units, ropes and ploughs are financed*		✓
agricultural: seeds		✓

Other incentives or instruments
Open days.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation?				✓
Did the Approach enable evidence-based decision-making? *The demonstration sites and the open days allowed non-trained producers to see the advantages experienced by trained producers. A study conducted in November 2016 showed that the adoption rate of the technology was up to 96% for the trained producers and up to 88% for the non-trained producers in the targeted villages*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *The consideration of the real needs of producers by involving them in the process has motivated them in the adoption and implementation of the technology.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The approach does not provide for access to financial resources.*	✓			
Did the Approach improve knowledge and capacities of land users to implement SLM? *The capacities of all the targeted producers have been strengthened, and they have all been able to upscale the technologies.*				✓
Did the Approach improve knowledge and capacities of other stakeholders? *Apart from the targeted producers, the knowledge and capacities of the agricultural advisers were improved.*				✓
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *The collaboration of the project team with the department of agriculture was strengthened.*				✓

Did the Approach empower socially and economically disadvantaged groups? ☑

Did the Approach improve gender equality and empower women and girls? ☑
Women are involved in the same way as men.

Did the Approach lead to improved food security/ improved nutrition? ☑
The yields of cowpea could be increased more than 500%, and millet more than 250%.

Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? ☑
The approach helps producers to grow varieties with higher tolerance to long dry periods.

REDUCE

Main motivation of land users to implement SLM

- ☑ increased production
- ☑ increased profit(ability), improved cost-benefit-ratio
- ☐ reduced land degradation
- ☑ reduced risk of disasters
- ☐ reduced workload
- ☐ payments/ subsidies
- ☐ rules and regulations (fines)/ enforcement
- ☐ prestige, social pressure/ social cohesion
- ☐ affiliation to movement/ project/ group/ networks
- ☐ environmental consciousness
- ☐ customs and beliefs, morals
- ☐ enhanced SLM knowledge and skills
- ☐ aesthetic improvement
- ☐ conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- ☐ no
- ☑ yes
- ☐ uncertain

Comment: The producers have already initiated other producers into the use of the technologies. Dissemination is done from producer to producer, and in a participatory way.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Our involvement in the entire process.
- The demand comes from ourselves.

Key resource person's view

- A better relationship between all stakeholders.
- Strengthening of the capacities of all actors.
- The consideration of the real needs of the producers.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- The meetings and the stakeholder engagement require resources. → *Financial assistance.*

Key resource person's view

- Approach subject to constraints (in terms of human and financial resources). → *Mobilisation of financial resources.*
- Lack of accompanying measures for the demonstrations. → *Mobilisation of financial resources.*
- Challenges in terms of organisation (high cost and organisational capacity). → *Mobilisation of financial resources.*

REFERENCES

Compiler: Judith Macchi - judith.macchi@heks.ch

Resource persons: Ibrahim Baoua (baoua.ibrahim@gmail.com) - SLM specialist

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_680/

Linked SLM data: SLM Technology: Multi-nutritional fodder blocks for livestock https://qcat.wocat.net/en/wocat/technologies/view/technologies_700/
SLM Technology: Improved cowpea variety (IT90k372-1-2) https://qcat.wocat.net/en/wocat/technologies/view/technologies_663/
SLM Technology: Improved pearl millet variety HKP https://qcat.wocat.net/en/wocat/technologies/view/technologies_661/

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Links to relevant information which is available online:

Documents of the West African Power Pool (WAPP) from Niger, Senegal, Ghana, Mali, Ivory Coast and Nigeria: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Policy-Documents/DSIR%20pour%20l'Afrique%20d



Preparation of multi-nutritional fodder blocks in the production unit at Maitsakoni (Abdou Razak Bawa).

Multi-nutritional fodder blocks for livestock (Niger)

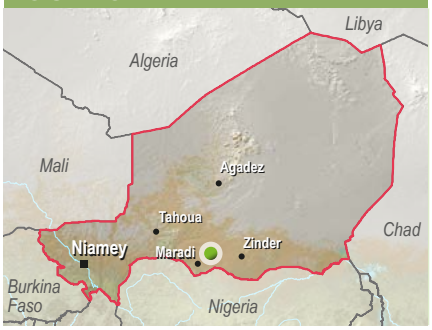
Lassar Dabbobi

DESCRIPTION

Multi-nutritional fodder blocks for livestock are a supplementary animal feed for all seasons. They are a concentrate of nutritious elements prepared from crop residues including stover and pods.

Livestock rearing is the second biggest economic activity in Niger after crop farming. It contributes to food security by providing a substantial income to pastoralist households. However, due to the increasing pressure on grazing land because of recurrent drought and land degradation, livestock rearing is becoming more and more difficult. This accentuates the vulnerability of pastoralists. The annual fodder balance for livestock, which depends on the amount of rain, is regularly in deficit, thereby reducing security. The supply of edible dry biomass is insufficient in most years, and hence the requirements for digestible nitrogen and both vitamin A and E, required for growth and the production of milk, are not covered. Phosphorus is also essential for metabolism, and must be supplied in sufficient quantity, otherwise it jeopardieses survival of the animals. This necessitates supplements to raise the quality of animal feed. Considering these critical and recurrent fodder deficits in Niger, the FAO, in collaboration with the National Agronomic Research Institute of Niger (INRAN), has initiated and tested the production of "multi-nutritional fodder blocks" (MNFB). Agricultural by-products like the stover (stalks and leaves) of millet, sorghum, maize or rice are crushed and mixed with micro-nutrients (e.g. phosphorus and salt), vitamins and binders (e.g. gum arabic), and are compacted such that the product can be nibbled by herbivorous livestock. Sahelbio (financed by HEKS/ EPER - Swiss Church Aid) has adopted this technology under a project that supports food security of rural households through agro-ecological intensification in the department of Mayahi. The production units for the MNFB are located in the villages, and are managed by village committees. The blocks are produced in the form of bricks. The main equipment required for producing the bricks includes shredders, mixture containers, moulds, scales, and hand tools. The blocks are sold locally, or at the markets, and thus constitute a source of additional income. The MNFBs constitute a vital supplementary feed for livestock in the period between harvests, or in years with critical fodder deficits. In this way, the blocks support milk and meat production, and the dependency on imported food decreases. Apart from the advantages for the animals, the technology promotes re-use of crop residues, while simultaneously encouraging land users to maintain good vegetative cover - through mobile fencing, storage of stalks, and weed control etc.

LOCATION



Location: Mayahi, Maradi, Niger

No. of Technology sites analysed: 2-10 sites

Geo-reference of selected sites
- 7.67223, 13.95743

Spread of the Technology: evenly spread over an area (approx. 10-100 km²)

Date of implementation: 2014

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions



Shredding of stalks and mixing of the various ingredients (Abdou Razak Bawa).



Fodder blocks (Abdou Razak Bawa).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- ✓ improve production
  - reduce, prevent, restore land degradation
  - conserve ecosystem
  - protect a watershed/ downstream areas – in combination with other Technologies
  - preserve/ improve biodiversity
  - reduce risk of disasters
  - adapt to climate change/ extremes and its impacts
  - mitigate climate change and its impacts
- ✓ create beneficial economic impact
  - create beneficial social impact
- ✓ mitigate the livestock food crisis and improve the production and productivity of herbivores

Land use





Cropland - Annual cropping
Main crops (cash and food crops): Millet, sorghum, groundnuts, sesame
Grazing land - Main animal species and products: Goats, sheep, cattle, donkeys
Extensive grazing land: Semi-nomadism/ pastoralism Intensive grazing/ fodder production: Cut-and-carry/ zero grazing

Water supply

- ✓ rainfed
  - mixed rainfed-irrigated
  - full irrigation

Comment: Most of the ingredients (stalks, pods and fruits) are harvested after the rainy season.

Number of growing seasons per year: 1
Land use before implementation of the Technology: n.a.
Livestock density: n.a.

Purpose related to land degradation

- prevent land degradation
- ✓ reduce land degradation
  - restore/ rehabilitate severely degraded land
  - adapt to land degradation
  - not applicable

Degradation addressed



chemical soil deterioration - Cn: fertility decline and reduced organic matter content (not caused by erosion)

Comment: The animals help to fertilize the soil with their manure.

SLM group

- pastoralism and grazing land management
- integrated crop-livestock management
- improved plant varieties/ animal breeds

SLM measures



vegetative measures - V3: Clearing of vegetation

Comment: This technology promotes the recovery and utilisation of crop residues.

TECHNICAL DRAWING

Technical specifications

The fodder blocks are fed to the animals in a trough in the form of pellets or crushed blocks. The intake capacity of the blocks for grazing animals is 1.5 to 2 kg for mature smallstock (goats and sheep) and 7 to 10 kg for cattle, per day.

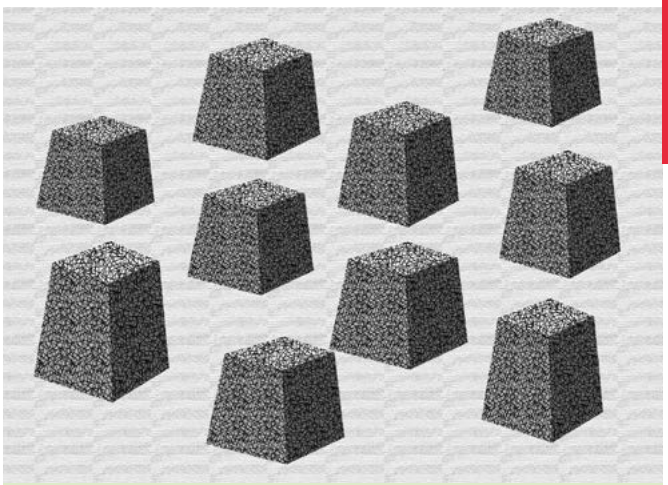


Figure: Fodder blocks (HEKS / EPER).

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: per **20 kilogram of MNFB**)
- Currency used for cost calculation: **CFA franc**
- Exchange rate (to USD): 1 USD = 550.0 CFA francs.
- Average wage cost of hired labour per day: 1000 CFA francs.

Most important factors affecting the costs

Ingredients, diesel.

Establishment activities

1. Shredding of stalks (Management; From December to May)
2. Measurement of input quantities (Management)
3. Mixing of inputs in a container (Management)
4. Moulding of blocks (Management)
5. Drying of blocks (Management)
6. Sale (Other measures)

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Production of blocks	person days	4.0	1000	4000	100
Equipment					
Shredder		1.0	700	700	0
Bucket		4.0	700	1200	0
Container		2.0	800	1600	0
Mould		1.0	400	400	0
Diesel litre	litre	1.0	400	400	0
Motor oil litre	litre	1.0	300	300	0
Mat	pieces	1.0	50	50	0
Plant material					
Stalks of millet or sorghum	pieces	3.0	200	600	100
Cowpea stover	kg	4.0	200	800	100
Bran	pieces	4.0	200	800	100
Salt	pieces	1.0	175	175	100
Acacia pods		1.0	150	150	100
Piliastigma reticulatum (Kalgo) pods		1.0	150	150	100
Binder		1.0	125	125	100
Water		150.0	2	300	93
			Total costs for establishment of the Technology	**11750 CFA francs**	

Comment: The costs refer to the manufacture of 20 kg.

Maintenance activities

1. Shredding of stalks (Management; From December to May)
2. Measurement of input quantities (Management)
3. Making of blocks (Management)
4. Mixing of inputs in a container (Management)
5. Moulding of blocks (Management)
6. Drying of blocks (Management)
7. Sale (Other measures)

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Production of blocks	person days	4.0	1000	4000	100
Equipment					
Gas-oil	litre	1.0	400	400	100
Plant material					
Stalks of millet or sorghum	kg	3.0	200	600	100
Cowpea stover	kg	4.0	200	800	100
Bran	kg	4.0	200	800	100
Salt	kg	1.0	175	175	100
Acacia pods	kg	1.0	150	150	100
Kalgo pods	kg	1.0	150	125	100
Cement	kg	1.0	125	125	100
Water	litre	150.0	2	300	100
Total costs for maintenance of the Technology				**7500 CFA francs**	

Comment: The annual cost depends on the production level.

NATURAL ENVIRONMENT

Average annual rainfall
- ✓ < 250 mm
- 251-500 mm
- 501-750 mm
- 751-1000 mm
- 1001-1500 mm
- 1501-2000 mm
- 2001-3000 mm
- 3001-4000 mm
- > 4000 mm

Agro-climatic zone
- humid
- sub-humid
- ✓ semi-arid
- arid

Specifications on climate

Average annual rainfall in mm: 250.0
Rainy season from July to September
Name of the meteorological station: Mayahi

Slope
- ✓ flat (0-2%)
- gentle (3-5%)
- moderate (6-10%)
- rolling (11-15%)
- hilly (16-30%)
- steep (31-60%)
- very steep (>60%)

Landform
- ✓ plateau/ plains
- ridges
- mountain slopes
- hill slopes
- footslopes
- valley floors

Altitude
- ✓ 0-100 m a.s.l.
- 101-500 m a.s.l.
- 501-1000 m a.s.l.
- 1001-1500 m a.s.l.
- 1501-2000 m a.s.l.
- 2001-2500 m a.s.l.
- 2501-3000 m a.s.l.
- 3001-4000 m a.s.l.
- > 4000 m a.s.l.

Technology is applied in
- convex situations
- concave situations
- ✓ not relevant

Soil depth
- ✓ very shallow (0-20 cm)
- shallow (21-50 cm)
- moderately deep (51-80 cm)
- deep (81-120 cm)
- very deep (> 120 cm)

Soil texture (topsoil)
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- ✓ coarse/ light (sandy)
- medium (loamy, silty)
- fine/ heavy (clay)

Topsoil organic matter content
- high (>3%)
- medium (1-3%)
- ✓ low (<1%)

Groundwater table
- on surface
- < 5 m
- ✓ 5-50 m
- > 50 m

Availability of surface water
- excess
- good
- medium
- ✓ poor/ none

Water quality (untreated)
- good drinking water
- ✓ poor drinking water (treatment required)
- fine/ heavy (clay)
- for agricultural use only (irrigation)
- unusable

Is salinity a problem?
- yes
- ✓ no

Occurrence of flooding
- yes
- ✓ no

Species diversity
- high
- medium
- ✓ low

Habitat diversity
- high
- medium
- ✓ low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- subsistence (self-supply)
- ✓ mixed (subsistence/ commercial
- commercial/ market

Off-farm income
- ✓ less than 10% of all income
- 10-50% of all income
- > 50% of all income

Relative level of wealth
- ✓ very poor
- poor
- average
- rich
- very rich

Level of mechanisation
- ✓ manual work
- animal traction
- mechanised/ motorised

Sedentary or nomadic
- ✓ Sedentary
- Semi-nomadic
- Nomadic

Individuals or groups
- ✓ individual/ household
- groups/ community
- cooperative
- employee (company, government)

Gender
- ✓ women
- ✓ men

Age
- children
- ✓ youth
- ✓ middle-aged
- elderly

Area used per household
- < 0.5 ha
- 0.5-1 ha
- ✓ 1-2 ha
- 2-5 ha
- 5-15 ha
- 15-50 ha
- 50-100 ha
- 100-500 ha
- 500-1000 ha
- 1000-10000 ha
- > 10000 ha

Scale
- small-scale
- ✓ medium-scale
- large-scale

Land ownership
- state
- company
- communal/ village
- group
- ✓ individual, not titled
- individual, titled

Comment: Access to land is through inheritance, purchase or leasing.

Land use rights
- open access (unorganised)
- communal (organised)
- leased
- ✓ individual

Water use rights
- open access (unorganised)
- ✓ communal (organised)
- leased
- individual

Access to services and infrastructure

health	poor	✓					good
education	poor		✓				good
technical assistance	poor	✓					good
employment (e.g. off-farm)	poor	✓					good
markets	poor		✓				good
energy	poor	✓					good
roads and transport	poor	✓					good
drinking water and sanitation	poor	✓					good
financial services	poor	✓					good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

fodder production	decreased						✓	increased
fodder quality	decreased					✓		increased
animal production	decreased					✓		increased
diversity of income sources	decreased					✓		increased

Socio-cultural impacts

food security/ self-sufficiency	reduced					✓		improved
SLM/ land degradation knowledge	worsened						✓	improved
situation of socially and economically disadvantaged groups (gender, age, status, ethnicity etc.)	reduced						✓	improved

Ecological impacts

drought impacts	increased					✓		decreased

Benefits compared with establishment costs

Short-term returns	very negative						✓	very positive
Long-term returns	very negative						✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	☑ very positive
Long-term returns	very negative	☑ very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Gradual climate change

seasonal temperature increase	not well at all	☑ very well	Season: dry season
variability of the rainfall	not well at all	☑ very well	Specify: increase in precipitation variability, variation between the seasons

Climate-related extremes (disasters)

drought	not well at all	☑ very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- ☐ single cases/ experimental
- ☐ 1-10%
- ☑ 10-50%
- ☐ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ☑ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ☐ 90-100%

Has the Technology been modified recently to adapt to changing conditions?

- ☐ Yes
- ☑ No

Comment: The implementation of the technology requires sizeable assets like shredders, which are not easy to acquire in a rural environment where the means are often lacking.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Increase in livestock production (breeding, milk, meat etc). This technology helps generate income. Livestock become more valuable.

Key resource person's view

- Transfer of skills
- Tackling food insecurity through the quality of food supply
- Improvement of the living standard of the producers.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Sales difficulties, lack of entrepreneurial spirit. → *Establishment of a marketing mechanism.*
- The high sensitivity of the fodder blocks to fungi. → *Optional drying of the products.*

Key resource person's view

- Adoption rate of technology relatively low. → *Building of entrepreneurial spirit.*

REFERENCES

Compiler: Judith Macchi - judith.macchi@heks.ch
Resource persons: Bawa Abdourazak (arazakbawa@gmail.com) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/ technologies_700/
Linked SLM data: SLM Approach: Training and awareness-raising in the use of improved agricultural techniques https://qcat.wocat.net/en/wocat/approaches/view/ approaches_680/
Documentation was facilitated by: HEKS (Hilfswerk der Evangelischen Kirchen Schweiz) - Switzerland

Key references
Links to relevant information which is available online
Boosting agricultural production to prevent food crises: http://www.fao.org/fileadmin/user_upload/emergencies/docs/Niger_ERCU_Bulletin_1.pdf
Niger: multi-nutritional densified blocks for livestock: http://www.waapp-ppaao.org/sites/default/files/fiche_bmn_2.pdf
The Technology of Multi-Nutritional Blocks in Niger: https://www.youtube.com/watch?v=MH7qfQnFuYE



Women from Machowda village, Bihar is drying the grain for the multigrain nutrient ball preparation. (Mr. Ranjan)

Multigrain nutrient ball (India)

Horlicks laddoo (or "Deshi" Horlicks)

DESCRIPTION

Multigrain nutrient balls can help to prevent malnutrition in rural communities by enhancing resilience to food shortages caused by natural disasters such as floods.

Multigrain flour can be used to produce both nutrient balls and energy drinks. The multigrain flour is composed of seven grains, namely rice, wheat, finger millet (*Eleusine coracana*), maize, green grams, chick pea (*Cicer arietinum*) and common or field pea (*Pisum sativum*). These cereal and legume grains are rich in vitamins and minerals. The nutrient ball, locally named "Horlicks laddoo" (or "Deshi" Horlicks), has a particularly high nutritional value and is being promoted within the rural communities in the target villages of the NGO "Nirmal Mahila Kalyan Kendre" (NMKK), especially for women and children. It is also used as an energy drink, particularly for children, preventing malnutrition.

Equal quantities of rice, wheat, finger millet, green grams, maize, chick pea and pea are soaked separately in water for 24 hours. Then are tied in a soft wet cotton cloth for 1 or 2 days until the grains sprout. Once the sprouts emerge, the grains are dried in the sun and afterwards fried separately - one by one. After being fried, the husk is removed from the chick peas, peas and green grams. Finally, all the grains are ground together in a mill. Once the flour is ready, as part of the value addition process, ghee and jaggery (unrefined brown sugar made from sugar cane or palm tree) are added and mixed thoroughly. Optionally, 100 grams of raisins and cashew nuts can be added to the products. After mixing well, the powder can either be kept as it is or shaped into balls.

The process of dry frying without extra water maintains the nutritional value intact and leads to a longer shelf life. The rich content of vitamins, minerals and carbohydrates makes the nutrient balls particularly valuable for children, adolescents and pregnant women, preventing malnutrition. They are also suitable for people suffering from diabetes, if consumed without sugar. The prime objective of this technology is to prevent malnutrition (and eliminate anaemia) among the rural poor, especially among women and children. In situations of emergency - such as those caused by floods - it helps in Disaster Risk Reduction. Furthermore, these nutrient balls can also be an additional source of income once people become aware of the high nutritional level and a demand is created.

LOCATION



Location: Town-Darbhanga, BIHAR, India

No. of Technology sites analysed: 10-100 sites

Geo-reference of selected sites
- 85.89306, 26.10777

Spread of the Technology: applied at specific points/ concentrated on a small area

Date of implementation: 2003

Type of introduction
- through land users' innovation
- as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

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Grains are sprouted and processed for the preparation of Horlicks Laddoo (Mr.Ranjan).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- ✓ mitigate climate change and its impacts
- create beneficial economic impact
- create beneficial social impact
- ✓ It helps in prevention of malnutrition among women and children

Purpose related to land degradation

- prevent land degradation
- reduce land degradation
- restore/ rehabilitate severely degraded land
- adapt to land degradation
- ✓ not applicable

SLM group

- post-harvest measures

SLM measures

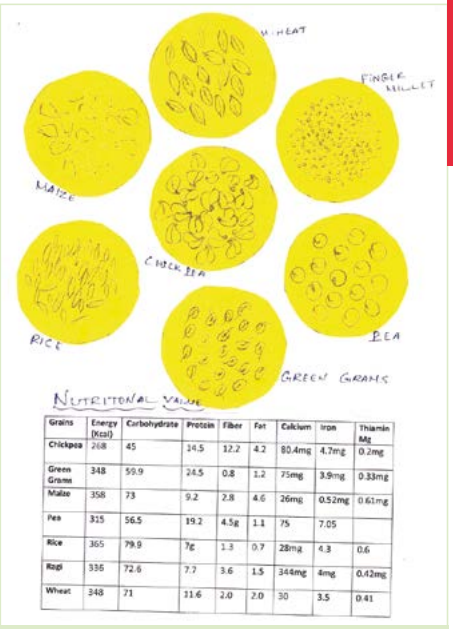
other measures: post-harvest

TECHNICAL DRAWING

Technical specifications

Ingredients:
Maize - 1 kg; Wheat - 1 kg; Green Grams - 1 kg; Finger Millet - 1 kg; Rice - 1 kg; Chick pea - 1 kg; Pea - 1 kg
Glucose powder - 500 gm; Jaggery - 3 kg
For preparation instructions, refer to the main description.

Preparation:
The grains are mixed in equal quantities, e.g. 1 kg of each grain. They are soaked separately in water for 24 hours. After being soaked well, rice wheat, finger millet, green grams, maize, cheak peas are tied in a soft wet cotton cloth for 1 or 2 days until they sprout. Once the sprouts have emerged, the grains are dried in the sun and afterwards fried separately one by one. After being fried, the husk is removed from cheak peas and green grams. After finishing the cleaning process, they are put together for the completion of the product. Finally, all grains are ground together in a mill. Once the flour is ready, as part of the value addition process ghee and jaggery (unrefined brown sugar made of sugar cane or palm tree) are added and mixed thoroughly. If needed, 100 grams of raisin and cashew nut can be added. After mixing well, it can be shaped into balls or kept as a powder. The process of dry roasting keeps the nutritional value intact and leads to a longer shelf life. The rich content of vitamins, minerals and carbohydrates makes the nutritional balls particularly valuable for children, adolescents and pregnant women, preventing malnutrition. They are also suitable for people suffering from diabetics, if consumed without sugar.



Grains	Energy (Kcal)	Carbohydrate	Protein	Fiber	Fat	Calcium	Iron	Thiamin Mg
Chickpea	268	45	14.5	12.2	4.2	80.4mg	4.7mg	0.2mg
Green Grams	348	59.9	24.5	0.8	1.2	75mg	3.9mg	0.33mg
Maize	358	73	9.2	2.8	4.6	26mg	0.52mg	0.61mg
Pea	315	56.5	19.2	4.5g	1.1	75	7.05	
Rice	365	79.9	7g	1.3	0.7	28mg	4.3	0.6
Ragi	336	72.6	7.7	3.6	1.5	344mg	4mg	0.42mg
Wheat	348	71	11.6	2.0	2.0	30	3.5	0.41

Figure: Sr. Roselin

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **8 kg of nutritious multi-grain flower**)
- Currency used for cost calculation: **Rupees**
- Exchange rate (to USD): 1 USD = 67.0 Rupees
- Average wage cost of hired labour per day: n.a.

Most important factors affecting the costs

Investment costs.

Establishment activities

1. Preparation of the food balls (other measures; whenever).

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Grinding Charge	1 kg	8.0	5	40	100
Equipment					
Vessels	8	8.0	120	960	100
Cotton Cloth	7 pcs	4.0	148	592	100
Tharpaulin	1 pc	1.0	1500	1500	100
Plant material					
Pulses (Chick Pea,Pea,Green grams)	3 kg	3.0	120	360	100
Cereals (Wheat, Maize, Finger Millet, Rice)	4 kg	3.0	30	90	100
Packing Polythen	1 kg	1.0	200	200	100
Total costs for establishment of the Technology				**3742 Rupees**	

NATURAL ENVIRONMENT

Average annual rainfall

- ☐ < 250 mm
- ☐ 251-500 mm
- ☐ 501-750 mm
- ☐ 751-1000 mm
- ☑ 1001-1500 mm
- ☐ 1501-2000 mm
- ☐ 2001-3000 mm
- ☐ 3001-4000 mm
- ☐ > 4000 mm

Agro-climatic zone

- ☐ humid
- ☑ sub-humid
- ☐ semi-arid
- ☐ arid

Specifications on climate

Average annual rainfall in mm: 1150

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [x] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [ ] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [x] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [ ] coarse/ light (sandy)
- [ ] medium (loamy, silty)
- [x] fine/ heavy (clay)

Topsoil organic matter content
- [x] high (>3%)
- [ ] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [x] excess
- [ ] good
- [ ] medium
- [ ] poor/ none

Water quality (untreated)
- [ ] good drinking water
- [x] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [x] yes
- [ ] no

Species diversity
- [ ] high
- [ ] medium
- [x] low

Habitat diversity
- [x] high
- [ ] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [x] subsistence (self-supply)
- [ ] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [x] very poor
- [ ] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [x] manual work
- [ ] animal traction
- [ ] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [ ] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [ ] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [ ] men

Age
- [ ] children
- [ ] youth
- [x] middle-aged
- [x] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [ ] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [x] individual, titled

Land use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [x] leased
- [x] individual

Water use rights
- [ ] open access (unorganised)
- [ ] communal (organised)
- [x] leased
- [x] individual

Access to services and infrastructure

technical assistance	poor		✓			good
markets	poor	✓				good
energy	poor			✓		good
roads and transport	poor			✓		good
financial services	poor			✓		good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

diversity of income sources	decreased					✓		increased

Socio-cultural impacts

health situation	worsened					✓		improved

Ecological impacts
flood impacts — increased ☐☐☐☐☐✓☐ decreased

Off-site impacts
Improved health condition of women and children — decreased ☐☐☐☐☐✓☐ increased

Benefits compared with establishment costs
Short-term returns — very negative ☐☐☐☐☐✓☐ very positive
Long-term returns — very negative ☐☐☐☐☐☐✓ very positive

Benefits compared with maintenance costs
Short-term returns — very negative ☐☐☐☐☐✓☐ very positive
Long-term returns — very negative ☐☐☐☐☐✓☐ very positive

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology
- ☐ single cases/ experimental
- ☐ 1-10%
- ✓ 10-50%
- ☐ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?
- ☐ 0-10%
- ☐ 10-50%
- ☐ 50-90%
- ✓ 90-100%

Number of households and/ or area covered
100HHs -200HHs

Has the Technology been modified recently to adapt to changing conditions?
- ☐ Yes
- ✓ No

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view
- Multi grain nutrient ball is particularly meant for pregnant women and lactating mother.
- It helps against malnutrition of children.
- It is rich in vitamin, minerals and energy.
- During disaster situations, especially floods, this will serve as a balanced nutrition.
- It can also be consumed by persons with diabetes as a porridge.

Key resource person's view
- This can be included in the regular diet of rural women and children if they are suffering from anaemia and undernourishment.
- It can provide alternative income generation adding quality to the product with little investment.
- It can be included in the flood preparedness list of dry foods and utilised during flood.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view
- People prefer Horlicks from market over homemade Horlicks due to the time required for preparation. → *Awareness raising within the community regarding the technology.*
- High price increase of grains especially for pulses in recent years in India. → *Grain and pulses that are produced by the health network leaders and can be exchanged within the networks or sold at moderate rates.*
- Ignorance of nutritional value of the product. → *Some success stories/ case studies have to be made visible to the community regarding the benefits of Horlicks laddoo.*
- Low appreciation of local products. → *Training on Entrepreneurship must be given to the women.*

Key resource person's view
- People do not want to try it/ practice it. → *Group of interested women has to be motivated to initiate this technology.*
- Marketing availability is one of the key issue. → *Organisation must facilitate market availability till the product gets public attraction.*
- Lack of Business orientation among the women. → Women must be given Entrepreneurial skill that includes savings from fees from water sales. *Funds could also potentially be acquired from the county government or NGOs.*

REFERENCES

Compiler: Maria Roselin – nmkkdarbhanga@gmail.com
Resource persons: Maria Roselin (nmkkdarbhanga@gmail.com) – SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_731/
Video: https://player.vimeo.com/video/212079785
Linked SLM data: SLM Approach: Fighting malnutrition by promoting locally produced Horlicks: https://qcat.wocat.net/en/wocat/approaches/view/approaches_1775/
Documentation was facilitated by: CARITAS

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami			☑		
Flood		☑			
Extreme Temperature	☑				
Drought	☑				
Biological hazards					
Animal / rodents incidents		☑			
Man-made hazards					
Fire	☑				

Vulnerability – capacity profile of the site before the Technology was applied

Exposure							
of people	very high/ strong	☑					very low/ non-existent
of private assets	very high/ strong	☑					very low/ non-existent
ofcommunityland	very high/ strong	☑					very low/ non-existent
ofcommunityinfrastructure	very high/ strong	☑					very low/ non-existent
Economic factors							
Access to markets	very high/ strong				☑		very low/ non-existent
Income	very high/ strong					☑	very low/ non-existent
Diversification of income	very high/ strong					☑	very low/ non-existent
Savings/stocks	very high/ strong					☑	very low/ non-existent
Bank savings/remittances	very high/ strong					☑	very low/ non-existent
Degree insurance coverage	very high/ strong					☑	very low/ non-existent
Social factors							
Literacy rate	very high/ strong				☑		very low/ non-existent
Government support	very high/ strong				☑		very low/ non-existent
Family support	very high/ strong		☑				very low/ non-existent
Community support	very high/ strong			☑			very low/ non-existent
Access to public services	very high/ strong					☑	very low/ non-existent
Physical factors							
Robustness of houses	very high/ strong				☑		very low/ non-existent
Robustness of infrastructure	very high/ strong			☑			very low/ non-existent

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- substantial increase in losses
- some increase in losses
- no change
- small reduction in losses
- ☑ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
0	0
1	1
☑ 2-5	2-5
6-10	6-10
11-50	11-50
> 50	☑ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
0	0
1-10	1-10
11-50	11-50
51-100	51-100
☑ 101-200	101-200
201-500	201-500
> 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
0% (no damage)	0% (no damage)
1-20%	1-20%
☑ 21-50%	21-50%
51-80%	51-80%
80-100%	☑ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
0% (no damage)	0% (no damage)
1-20%	1-20%
21-50%	☑ 21-50%
☑ 51-80%	51-80%
80-100%	80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
0 USD	0 USD
☑ 1-1000 USD	1-1000 USD
1001-5000 USD	1001-5000 USD
5001-10'000 USD	5001-10'000 USD
10'001-50'000 USD	☑ 10'001-50'000 USD
50'000-250'000 USD	50'000-250'000 USD
> 250'000 USD	> 250'000 USD

Duration since last disaster

- < 3 months
- 3-6 months
- 7-12 months
- 1-2 years
- 2-5 years
- ☑ 5-10 years
- > 10 years

Protection goal of SLM Technology

The goal of the Technology is protecting Women, Children and adolescent girls from becoming prey to Anaemia and malnourishment.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased		☑ increased
Evacuation and shelter	decreased		☑ increased
Safety of esp. vulnerable	decreased		☑ increased
Early warning	decreased	☑	increased
Safety of key documents	decreased		☑ increased

Economic goods (on-site)

safety of individual housing	decreased		☑ increased
safety of water stocks	decreased		☑ increased
Safety of seed/animal stocks	decreased		☑ increased
safety of land assets	decreased		☑ increased
Safety of communal assets	decreased		☑ increased

Off-site impacts

None



Deshi Horlicks (Local Horlicks) in the form of balls (Sr. Roseline).

Fighting malnutrition by promoting locally produced Horlicks (India)

Horlicks Laddoo (or 'Deshi' Horlicks)

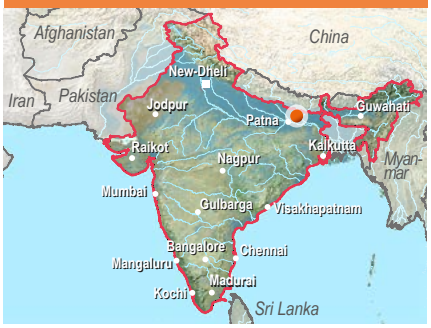
DESCRIPTION

Multigrain nutrient balls help fight malnutrition and improve the health of rural communities especially during and after floods, droughts and other.

Multigrain nutrient balls ('Deshi' Horlicks), or energy drinks made from the same ingredients, are suitable for all age groups. They contain the nutritional elements of carbohydrates, essential vitamins and minerals. The aim of supplying vulnerable groups with these supplements is to eradicate malnutrition among children and women, who are normally more vulnerable physically and prone to particular diseases, especially during - and following - natural disasters like floods and droughts. Children in rural areas up to the age of five are often malnourished due to their poor economic status, the lack of hygiene and malnourished mothers. Women in rural communities are commonly malnourished due to irregular meals, heavy work-loads and early marriages. People in rural area are busy throughout the day, and as well as not eating regularly, they don't consume nutritionally balanced meals due to poverty, and unavailability due to drought of essential vegetables and fruits. Consuming this local 'Deshi' Horlicks helps to provide nutritious essentials to those who need it most. This becomes even more important during and after disasters like floods when conventional food supplies are even more restricted. When the Community Health Education Development (CHED) programme was carried out among the rural communities, a survey found many women and children to be anaemic. The mortality and morbidity rate was high generally, and highest among women and children. In this situation the local development centre 'Nirmal Mahila Kalyan Kendre' (NMKK) realised the need to introduce a nutrition programme within the community. At the time, women were organised into Community Based Organisations (CBOs). This made the entry point easy. Women were continuously made aware about the purpose of maintaining health. NMKK took over the training and capacity building of women regarding this 'Deshi' Horlicks technology, focused on regular training sessions of midwives and ayurvedic practitioners (vaidhyas), who are responsible for community health. They, after being trained, implemented this approach in the community.

This technology was practiced within the community until recently. However, with the arrival in shops of national and international energy drinks, people started dropping good local practices like these. Women feel that it is too time consuming as they are continuously busy from early in the morning to late at night. They can also get readymade branded Horlicks powder in the shops. However, even today some of the women in the target region continue to make 'Deshi' Horlicks. NMKK perseveres to push for the re-establishment of this good practice in a sustainable manner.

LOCATION



Location: Darbhanga, Bihar, India

Geo-reference of selected sites

• 85.893065, 26.107775

Year of termination: n.a

Type of Approach

- ☐ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based

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Awareness-raising with a women's group (Mr. Ranjan).



The Technology is demonstrated by the implementing staff (Mr. Ranjan).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Eradicating malnutrition among women and children in rural areas.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** They are free to apply this technology in their environment.
- **availability/ access to financial resources and services:** If women need to develop this technology at a larger scale, they can access banks as well as use benefits from their group savings.
- **knowledge about SLM, access to technical support:** They are close to the organisation. Persons with technical skills are available and ready to provide support.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **markets (to purchase inputs, sell products) and prices:** In the rural areas, people don't understand the richness and value of these multigrain nutrient balls or energy drinks. They prefer to go for manufactured items and don't value the local products. This negative attitude towards locally produced food is a hindrance.
- **workload, availability of manpower:** Production requires several days, which people are increasingly unwilling to invest.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities:** Local communities, especially women, took part in the training programmes and invested a lot in community-based organisations. Self-help groups and health networks, which were part of the project activities, adopted this technology and implemented it.
- **SLM specialists/ agricultural advisers:** SLM specialists played the role of collecting information from the community related to this technology and compilation of the data.
- **international organisation (CARITAS Switzerland):** Financial support for the training programmes.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation	Specify who was involved and describe activities
initiation/ motivation				✓		NMKK organisation staff were involved in explaining the approach.
planning				✓		NMKK organisation staff were involved in planning with the community.
implementation				✓		NMKK staff supported them in implementing the Technology.
monitoring/ evaluation				✓		NMKK evaluated the activity.
training				✓		NMKK used trained persons to train other community members in implementing this Technology.

Decision-making on the selection of SLM Technology

Decisions were taken by

- [ ] land users alone (self-initiative)
- [ ] mainly land users, supported by SLM specialists
- [ ] all relevant actors, as part of a participatory approach
- [x] mainly SLM specialists, following consultation with land users
- [ ] SLM specialists alone
- [ ] politicians/ leaders

Decisions were made based on

- [ ] evaluation of well-documented SLM knowledge (evidence-based decision-making)
- [ ] research findings
- [x] personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- [x] Capacity building/ training
- [x] Advisory service
- [x] Institution strengthening (organisational development)
- [x] Monitoring and evaluation
- [x] Research

Capacity building/ training

Training was provided to the following stakeholders

- [ ] land users
- [x] field staff/ advisers

Form of training

- [ ] on-the-job
- [ ] farmer-to-farmer
- [x] demonstration areas
- [ ] public meetings
- [x] courses

Advisory service

Advisory service was provided

- [ ] on land users' fields
- [x] at permanent centres

Comment: An advisory service was available during the village visits.

Institution strengthening

Institutions have been strengthened/ established

- [ ] no
- [x] yes, a little
- [ ] yes, moderately
- [ ] yes, greatly

at the following level

- [ ] local
- [x] regional
- [ ] national

Describe institution, roles and responsibilities, members, etc.
Nirmal Mahila Kalyan Kendra is a social development centre that has been working for the social and economic empowerment and sustainable development of the vulnerable sections of the society for more than 20 years.

Type of support

- [ ] financial
- [x] capacity building/ training
- [ ] equipment

Monitoring and evaluation

Health staff monitor the women of the community to assess whether they regularly practice the technology. They also evaluate intermittently with the women to gauge how it helps them in fighting malnutrition.

Research

Research treated the following topics: health and nutrition aspects

- [x] sociology
- [ ] economics/ marketing
- [ ] ecology
- [ ] technology

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- [ ] < 2000
- [x] 2000-10000
- [ ] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Major donor: CARITAS Switzerland

Precise annual budget: n.a.

The following services or incentives have been provided to land users

- [ ] Financial/ material support provided to land users
- [ ] Subsidies for specific inputs
- [ ] Credit
- [ ] Other incentives or instruments

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach enable evidence-based decision-making? *Women found this technology effective when they first applied it. This created interest amongst them to adopt this technology.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *People were able to implement easily and maintain it to some extent.*				✓
Did the Approach improve knowledge and capacities of land users to implement SLM? *Of course this increased their capacity.*				✓
Did the Approach empower socially and economically disadvantaged groups? *Although it has not become an income generating source (at least so far) the health of women and children improved.*			✓	
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *This approach is applicable at all ages.*				✓
Did the Approach lead to improved food security/ improved nutrition? *The community uses the energy drink for all age classes from children to the elderly.*				✓
Did the Approach lead to employment, income opportunities? *This approach focuses only on improving human health.*	✓			

Main motivation of land users to implement SLM

- increased production
- increased profit(ability), improved cost-benefit-ratio
- reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- environmental consciousness
- customs and beliefs, morals
- enhanced SLM knowledge and skills
- aesthetic improvement
- conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: They need no external support. They know the significance of this technology well. They benefit from it whenever they feel the need.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- Reduction in the number of malnourished children in the community. The community can improve the health of its members, especially women and children. Constantly using this product will keep them active and healthy.

Key resource person's view

- People can get multi-nutritional elements especially during disasters (droughts and floods). This good practice is passed on to other women who are not part of this approach.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Arrival of national and international drinks reduced regular practice. → *Constant motivation regarding the significance of this approach to the community.*

Key resource person's view

- Decrease in agricultural productivity, as various disasters such as droughts, floods, cold waves or cyclones leave the land unproductive and affect its fertility and crop production.

REFERENCES

Compiler: Maria Roselin – nmkkdarbhanga@gmail.com
Resource persons: Maria Roselin - (nmkkdarbhanga@gmail.com) - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_1775/
Linked SLM data: SLM Technology: Multigrain nutrient ball https://qcat.wocat.net/en/wocat/technologies/view/technologies_731/
Documentation was facilitated by: CARITAS

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami			☑		
Flood		☑			
Extreme Temperature	☑				
Fog	☑				
Tropical cyclone	☑				
Drought	☑				
Biological hazards					
Animal / rodents incidents		☑			
Man-made hazards					
Fire	☑				

Vulnerability – capacity profile of the site before the Approach was applied

Exposure			
of people	very high/ strong	☑	very low/ non-existent
of private assets	very high/ strong	☑	very low/ non-existent
of community land	very high/ strong	☑	very low/ non-existent
of community infrastructure	very high/ strong	☑	very low/ non-existent
Economic factors			
Access to markets	very high/ strong	☑	very low/ non-existent
Income	very high/ strong	☑	very low/ non-existent
Diversification of income	very high/ strong	☑	very low/ non-existent
Savings/stocks	very high/ strong	☑	very low/ non-existent
Bank savings/remittances	very high/ strong	☑	very low/ non-existent
Degree insurance coverage	very high/ strong	☑	very low/ non-existent
Social factors			
Literacy rate	very high/ strong	☑	very low/ non-existent
Government support	very high/ strong	☑	very low/ non-existent
Family support	very high/ strong	☑	very low/ non-existent
Community support	very high/ strong	☑	very low/ non-existent
Access to public services	very high/ strong	☑	very low/ non-existent
Physical factors			
Robustness of houses	very high/ strong	☑	very low/ non-existent
Robustness of infrastructure	very high/ strong	☑	very low/ non-existent

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☑ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
0	0
1	1
☑ 2-5	2-5
6-10	6-10
11-50	11-50
> 50	☑ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
0	0
1-10	1-10
11-50	11-50
51-100	51-100
101-200	101-200
201-500	201-500
> 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
0% (no damage)	0% (no damage)
1-20%	1-20%
☑ 21-50%	21-50%
51-80%	51-80%
80-100%	☑ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
0% (no damage)	0% (no damage)
1-20%	1-20%
21-50%	☑ 21-50%
☑ 51-80%	51-80%
80-100%	80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
0 USD	0 USD
☑ 1-1000 USD	1-1000 USD
1001-5000 USD	1001-5000 USD
5001-10'000 USD	5001-10'000 USD
10'001-50'000 USD	☑ 10'001-50'000 USD
50'000-250'000 USD	50'000-250'000 USD
> 250'000 USD	> 250'000 USD

Duration since last disaster

- < 3 months
- 3-6 months
- 7-12 months
- 1-2 years
- 2-5 years
- ☑ 5-10 years
- > 10 years

Protection goal of SLM Approach

Preventing from malnutrition the most vulnerable section that are women especially pregnant and lactating women, children and adolescent girls.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased	☑ increased
Evacuation and shelter	decreased	☑ increased
Safety of esp. vulnerable	decreased	☑ increased
Early warning	decreased	☑ increased
Safety of key documents	decreased	☑ increased

Economic goods (on-site)

Safety of individual housing	decreased	☑ increased
Safety of water stocks	decreased	☑ increased
Safety of seed/animal stocks	decreased	☑ increased
Safety of land assets	decreased	☑ increased
Safety of communal assets	decreased	☑ increased

Other impacts (on-site)

Health	decreased	☑ increased

Off-site impacts

None



Raised foundations protect emergency infrastructure from floods, providing shelter and access to health and water and sanitation facilities (Tuhin Samaddar).

Emergency infrastructure including shelter and linked transport infrastructure (Bangladesh)

Durjog-shahonshil abokathamo unnayon

DESCRIPTION

Emergency infrastructure - providing flood shelter for people and animals - is linked with transport and communications, flood-proof water sources as well as health and school facilities.

The technology applies to the specific context of the 'Char' land in Bangladesh, riverine sandy islands along the Jamuna River. More than 80% of the land in the intervention area can be classified as Char and is inhabited by 60% of the population: these are the people served by the project. Every year, especially during floods, the rivers deposit a huge amount of sediment that makes the land fertile. At the same time, river action washes away some of the Char land, which at times can be quite significant in area, and thus impacts on people's lives and livelihoods. Before the intervention, people living on Char land depended on their traditional early warning mechanisms - and were frequently surprised by floods that destroyed their crops and put their lives in danger. Due to recurring floods, people didn't have the means to improve their infrastructure and living environment. The Char land is characterised by its remoteness and lack of public infrastructure and services. The technology consists of setting up an emergency infrastructure and ensuring community access to these during times of floods. The emergency infrastructure includes specific flood shelters (for people and animals), flood-proof collective water sources and sanitation systems, transport infrastructure such as foot bridges and elevated rural roads, as well as flood-proof health and school facilities that also serve as emergency shelters during floods. The flood shelters are built on a raised bed of soil and located at sites, selected by the communities, that are known to be relatively better protected from flood and river erosion within the Chars. The purpose of the technology is to ensure safety and protection of assets during times of emergency and also to mitigate suffering related to floods. The site is selected by the community and must be connected through an elevated road to the nearest community. This arrangement helps people to get easy access during times of floods. The shelter has collective hygienic latrine facilities and safe water sources. People generally dismantle their housing while evacuating and reinstall it on the flood shelter. The major activities include facilitating the development of community-led risk reduction action plans and their implementation through community participation with engagement of local governance institutions. This includes maintenance of the infrastructure as the joint responsibility of the community and the local government. The creation of and access to emergency infrastructure coupled with the adaptation in the timing of farming activities due to increased linkage to flood related forecasting improves safety, health and livelihoods in general. The technology has furthermore led to mainstreaming of disaster risk management in policies and the approach of local government institutions. Increasingly the local government's cash and food for work programmes are targeting establishment and/or reinforcement of emergency infrastructure that can cater to a larger population. Since the technology is based on local knowledge and has been developed in consultation with the involved communities, it is generally well accepted with a fair degree of ownership and involvement. However, parts of the region are also prone to river erosion and this has a destructive impact on built infrastructures. The technology does not assure any safeguard against this form of uncertain river action.

LOCATION



Location: Kamarjani and Mollar Char Union (i.e. municipality) in Sadar Upazila and Haldia Union in Shaghata Upazila of Gaibandha District, North-Bengal, Bangladesh

No. of Technology sites analysed: > 1000 sites

Geo-reference of selected sites
- 89.66422, 25.34181
- 89.62981, 25.09197

Spread of the Technology: evenly spread over an area (approx. 1-10 km^2)

Date of implementation: 2014; less than 10 years ago (recently)

Type of introduction
- through land users' innovation
- ✓ as part of a traditional system (> 50 years)
- during experiments/ research
- ✓ through projects/ external interventions

Swiss Red Cross



Safety and health at the Community Resource Centre and Community Clinic. The structures are built on an elevated foundation to protect them from floods (Tuhin Samaddar).



Household plinth raising to better protect them against flooding (Tuhin Samaddar).

CLASSIFICATION OF THE TECHNOLOGY

Main purpose

- improve production
- reduce, prevent, restore land degradation
- conserve ecosystem
- protect a watershed/ downstream areas – in combination with other Technologies
- preserve/ improve biodiversity
- ✓ reduce risk of disasters
- adapt to climate change/ extremes and its impacts
- mitigate climate change and its impacts
- ✓ create beneficial economic impact
- ✓ create beneficial social impact

Land use





Cropland - Annual cropping
Main crops (cash and food crops): Paddy, wheat, maize, jute, chilli, pulses, sweet potato
Settlements, infrastructure - Settlements, buildings, Traffic: roads, railways

Comment: Despite the lack of public infrastructure and services and being exposed to natural hazards people tend to prefer to live in the 'Char' as it brings significant economic benefits for them: crops grow rapidly and abundantly with significantly lower input costs than on the mainland.

Water supply

- rainfed
- ✓ mixed rainfed-irrigated
- full irrigation

Number of growing seasons per year: 3
Livestock density: Cows, buffaloes, goats, sheep, donkeys and poultry are very common in the area. People rear these for draft (every household has at least a pair or more of oxen for cultivation/ transport) for milk, eggs and for meat.

Purpose related to land degradation

- prevent land degradation
- reduce land degradation
- restore/ rehabilitate severely degraded land
- ✓ adapt to land degradation
- not applicable

Degradation addressed



soil erosion by water - Wr: riverbank erosion, Wo: offsite degradation effects

SLM group

- emergency infrastructure, shelter and linked transportation infrastructure

SLM measures



structural measures - S9: Shelters for plants and animals, S11: Others



management measures - M4: Major change in timing of activities

Comment: In addition to the structural and management measures described above, the technology involves additional elements such as flood-proof collective water supply and sanitation systems and communication infrastructure.

TECHNICAL DRAWING

Technical specifications

The built structural mitigation options have following technical specification (foot = 0.3 metre):

1. Flood shelter: Dimension: Length-220' x Width-220' x Height- 5.5', Slope: 1:1.5, Capacity: 350 families, Construction material used: soil and turf (grass)
2. Raised school compound: Dimension: Length-112' x Width-75' x Height- 5.5', Slope: 1:1.5, Capacity: 540 person, Construction material used: soil and turf (grass)
3. Community Resource Centre and Community Clinic (CRC-CC): Dimension: Length-60' x Width-38' x Height- 5.6', Slope: 1:1.5, Capacity: 1500 families from 5 villages, Construction material used: soil and grass plantation, bricks, sand, cement, rod, iron angel and CGI sheet.
4. Disaster resilient tube well: Dimension: Length-5' 10" x Width-5' x Height- 3', Boring: 100 feet, Capacity: 200 families, Construction material used: bricks, sand, cement, rod, tube well head, pvc pipe, cylinder, piston rod etc. Vertical intervals: 2 in each village.
5. Concrete platform for (existing) tube well: Dimension: Length-4' 10" x Width-4' x Height- 1', Capacity: 100 families, Construction material used: bricks, sand, cement, pvc pipe
6. Wooden bridge: Dimension: Length-99' x Width-7' x Height- 12', Slope: 1:1.5, Capacity: 900 families approximately, Construction material used: wood, nails, tar, soil and grass plantation
7. Road construction/repair: Dimension: Length-925' x Width-12' x Height- 3' (from existing level), Slope: 1:1.5, Capacity: 3 villages (approx:1000 families), Construction material used: soil and turf (grass).

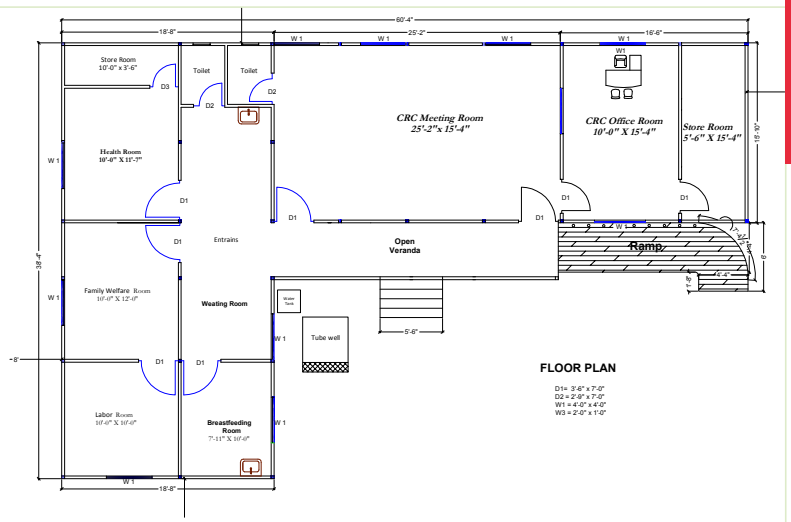


Figure: Abdur Razzak

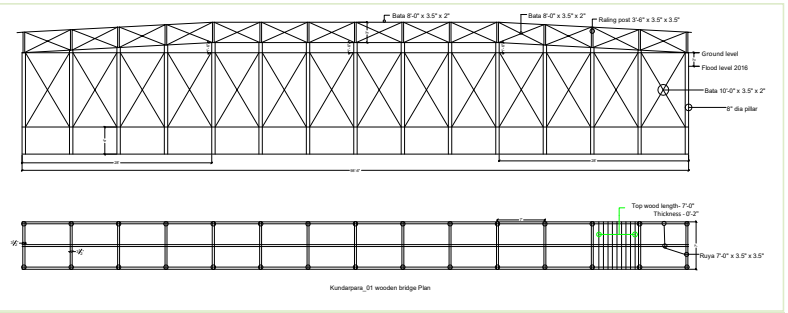


Figure: Abdur Razzak

ESTABLISHMENT AND MAINTENANCE: ACTIVITIES, INPUTS AND COSTS

Calculation of inputs and costs

- Costs are calculated: per Technology unit (unit: **flood shelter, raised school compound, disaster resilient tube well, concrete platform for (existing) tube well, wooden bridge, road construction/ repair** volume, length: **road: per metre**) Currency used for cost calculation: **Bangladeshi Taka (BDT)** Exchange rate (to USD): 1 USD = 79.0.
- Average wage cost of hired labour per day: 350 BDT.

Most important factors affecting the costs

Transportation of raw material from the mainland to the sites on the Char Islands varies across seasons. In the dry season it is much higher than during the monsoon as the delivery of material is easier in the latter due to extended river outreach.

Establishment activities

1. Construction of Flood Shelter (Structural; During dry season)
2. Raising school compound (Structural)
3. Construction of Community Resource Center (CRC) (Structural)
4. Installation of disaster resilient tube well (Structural)
5. Construction of concrete platform for (existing) tube well (Structural)
6. Construction of wooden bridge (Structural)
7. Road construction above flood level (Structural) All activities are structural in nature and can be undertaken efficiently only in dry season.

Establishment inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Flood shelter: earth work	m^3	8000.0	64	512000	10
CRC: earth work	m^3	53.0	139	7314	10
CRC: sand filling	m^3	302.0	99	29898	10
Raised school compound: earth work	m^3	1790.0	64	114560	10
Plant material					
Flood shelter: grass plantation (turfing)	m^2	4620.0	13	60060	10
Flood shelter: seedlings	piece	20.0	53	1060	10
CRC: grass plantation (turfing)	m^2	3890.0	13	50570	10
CRC: seedlings	piece	50.0	53	2650	10
Raised school compound: grass plantation (turfing)	m^2	1390.0	13	18070	10
Raised school compound: seedlings	piece	40.0	53	2120	10
Construction material					
CRC: roof truss	kg	4375.0	100	437500	
CRC: grill and iron work	m^2	88.0	2091	184008	
CRC: gypsum board	m^2	478.0	922	440716	
CRC: RCC work	m^3	2.9	19557	56715.3	
CRC: deformed bar	kg	397.0	85	33745	
CRC: boundary fencing	m^2	184.0	440	80900	
CRC: brick work	m^3	44.0	5515	242660	
Other					
CRC: electric ware and solar panel	lumpsum	1.0	73000	73000	
CRC: water supply	lumpsum	1.0	66150	66150	
CRC: transportation	lumpsum	1.0	89000	89000	
Total costs for establishment of the Technology				**2502756.3 BDT**	

Maintenance activities

1. Construction of Flood Shelter (Structural; During dry season)
2. Raising school compound (Structural)
3. Construction of Community Resource Centrer (CRC) (Structural)
4. Installation of disaster resilient tube well (Structural)
5. Construction of concrete platform or (existing) tube well (Structural)
6. Construction of wooden bridge (Structural)
7. Road construction above flood level (Structural)

Comment: Due to the softness of the sandy soil and the annual inundation, every measure requires considerable maintenance. The flooding generally washes out sands and undermines the foundation of the structure. If maintenance is done at regular intervals, the entire structure remains functional. Also, grass needs to be frequently replanted as it dries up during the dry season. The users and the local government (Union Disaster Management Committee) are mainly responsible for maintenance of all built assets and structures including the Community Resource Centre. The relevant operation/repair and maintenance training has been provided by the project. Maintenance manuals and guidelines have been developed and disseminated. Also, repair and maintenance equipment has been provided to a cadre of users/ caretakers trained in repair/maintenance work.

Maintenance inputs and costs

Specify input	Unit	Quantity	Cost per unit	Total cost per input	% of costs borne by land users
Labour					
Earthwork	m^3	80.0	63	35040	10
Sand bag filling	piece	50.0	15	750	10
Pipe fitting	piece	2.0	300	600	10
Mason	lumpsum	1.0	500	500	10
Plant material					
Grass plantation (turfing)	m^2	85.0	13	1105	10
Seedlings	piece	15.0	53	795	10
Construction material					
Plastic bag	piece	50.0	10	500	10
PVC pipe	m	15.0	120	1800	10
Polythene pipe	kg	5.0	160	800	10
Ciment	bag	0.5	540	270	10
Sand	ft^3	5.0	18	90	10
Caping socket	piece	2.0	35	70	10
Tape etc.	lumpsum	1.0	250	250	
Total costs for maintenance of the Technology				**12570.0 BDT**	

NATURAL ENVIRONMENT

Average annual rainfall
- [ ] < 250 mm
- [ ] 251-500 mm
- [ ] 501-750 mm
- [ ] 751-1000 mm
- [ ] 1001-1500 mm
- [ ] 1501-2000 mm
- [x] 2001-3000 mm
- [ ] 3001-4000 mm
- [ ] > 4000 mm

Agro-climatic zone
- [x] humid
- [ ] sub-humid
- [ ] semi-arid
- [ ] arid

Specifications on climate
Average annual rainfall in mm: 2134.8
Rainy season: April- October
Occurrence of heavy rain: June-July
Length of dry period: November-March
Name of the meteorological station: 18 Gaibandha Sadar, Gaibandha Tropical humid climatic zone.

Slope
- [x] flat (0-2%)
- [ ] gentle (3-5%)
- [ ] moderate (6-10%)
- [ ] rolling (11-15%)
- [ ] hilly (16-30%)
- [ ] steep (31-60%)
- [ ] very steep (>60%)

Landform
- [x] plateau/ plains
- [ ] ridges
- [ ] mountain slopes
- [ ] hill slopes
- [ ] footslopes
- [ ] valley floors

Altitude
- [x] 0-100 m a.s.l.
- [ ] 101-500 m a.s.l.
- [ ] 501-1,000 m a.s.l.
- [ ] 1001-1500 m a.s.l.
- [ ] 1501-2000 m a.s.l.
- [ ] 2001-2500 m a.s.l.
- [ ] 2501-3000 m a.s.l.
- [ ] 3001-4000 m a.s.l.
- [ ] > 4000 m a.s.l.

Technology is applied in
- [ ] convex situations
- [ ] concave situations
- [x] not relevant

Soil depth
- [ ] very shallow (0-20 cm)
- [x] shallow (21-50 cm)
- [ ] moderately deep (51-80 cm)
- [ ] deep (81-120 cm)
- [ ] very deep (> 120 cm)

Soil texture (topsoil)
- [ ] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [x] fine/ heavy (clay)

Soil texture (> 20 cm below surface)
- [x] coarse/ light (sandy)
- [x] medium (loamy, silty)
- [ ] fine/ heavy (clay)

Topsoil organic matter content
- [ ] high (>3%)
- [x] medium (1-3%)
- [ ] low (<1%)

Groundwater table
- [ ] on surface
- [ ] < 5 m
- [x] 5-50 m
- [ ] > 50 m

Availability of surface water
- [ ] excess
- [ ] good
- [x] medium
- [ ] poor/ none

Water quality (untreated)
- [x] good drinking water
- [ ] poor drinking water (treatment required)
- [ ] fine/ heavy (clay)
- [ ] for agricultural use only (irrigation)
- [ ] unusable

Is salinity a problem?
- [ ] yes
- [x] no

Occurrence of flooding
- [x] yes
- [ ] no

Species diversity
- [ ] high
- [x] medium
- [ ] low

Habitat diversity
- [ ] high
- [x] medium
- [ ] low

CHARACTERISTICS OF LAND USERS APPLYING THE TECHNOLOGY

Market orientation
- [ ] subsistence (self-supply)
- [x] mixed (subsistence/ commercial
- [ ] commercial/ market

Off-farm income
- [x] less than 10% of all income
- [ ] 10-50% of all income
- [ ] > 50% of all income

Relative level of wealth
- [ ] very poor
- [x] poor
- [ ] average
- [ ] rich
- [ ] very rich

Level of mechanisation
- [ ] manual work
- [x] animal traction
- [x] mechanised/ motorised

Sedentary or nomadic
- [x] Sedentary
- [x] Semi-nomadic
- [ ] Nomadic

Individuals or groups
- [x] individual/ household
- [x] groups/ community
- [ ] cooperative
- [ ] employee (company, government)

Gender
- [x] women
- [x] men

Age
- [ ] children
- [x] youth
- [x] middle-aged
- [ ] elderly

Area used per household
- [x] < 0.5 ha
- [ ] 0.5-1 ha
- [ ] 1-2 ha
- [ ] 2-5 ha
- [ ] 5-15 ha
- [ ] 15-50 ha
- [ ] 50-100 ha
- [ ] 100-500 ha
- [ ] 500-1000 ha
- [ ] 1000-10000 ha
- [ ] > 10000 ha

Scale
- [x] small-scale
- [ ] medium-scale
- [ ] large-scale

Land ownership
- [x] state
- [ ] company
- [ ] communal/ village
- [ ] group
- [x] individual, not titled
- [ ] individual, titled

Land use rights
- [x] open access (unorganised)
- [ ] communal (organised)
- [x] leased
- [ ] individual

Water use rights
- [ ] open access (unorganised)
- [x] communal (organised)
- [ ] leased
- [x] individual

Access to services and infrastructure

health	poor	✓			good
education	poor	✓			good
technical assistance	poor	✓			good
employment (e.g. off-farm)	poor	✓			good
markets	poor	✓			good
energy	poor	✓			good
roads and transport	poor	✓			good
drinking water and sanitation	poor	✓			good
financial services	poor		✓		good
access to mobile phone and internet	poor		✓		good

IMPACTS - BENEFITS AND DISADVANTAGES

Socio-economic impacts

Crop production — decreased ... ✓ increased

Before SLM: 3600 kg/ hectare (maize).
After SLM: 11400 kg/ hectare (maize).
Comment: Crop production has increased thrice due to the stability of households which has led to more intensively managed land in the Chars.

drinking water availability — decreased ... ✓ increased

Before SLM: No safe drinking water source was available.
After SLM: More than 40% of the water sources are safe.
Comment: Collective water supply systems have groundwater sources and thus no treatment is needed. Further, aspects of availability, easy access and sustainable availability of sufficient water of acceptable quality are well considered. Families can access 10 litres per capita per day (LPCD) during emergencies (which is in line with Sphere standards) and during normal times 40 LPCD is what families can collect from these water sources. All such water sources are within a distance of 50 m from the settlement as per Bangladesh standards.

drinking water quality — decreased ... ✓ increased

Before SLM: Reliable data not available
After SLM: All households have access to safe drinking water as per govt. standard for rural areas.
Comment: The collective water infrastructure built by the project ensures fulfillment of minimum standards set by the govt for safe drinking water.

farm income — decreased ... ✓ increased

Before SLM: 25% families had farm income.
After SLM: 95% families have farm income.
Comment: Cattle and poultry are safe during disaster.

Socio-cultural impacts

health situation	worsened	✓	improved	**Comment:** The disaster mitigation measures have signif icantly improved the health situation of the target population.
community institutions	weakened	✓	strengthened	**Before SLM:** Few credit groups in intervention villages Quantity. **After SLM:** 30 community based organisatons (i.e. village disaster management committees) and 3 Local Government Committees (Union disaster management committee). **Comment:** Community based organisations and government mandated institutions have been promoted through project initiatives.
conflict mitigation	worsened	✓	improved	**Before SLM:** Widespread. **After SLM:** Rare. **Comment:** The conflict sensitive approach has significantly reduced the incidence of conflicts.
national institutions	weakened	✓	strengthened	**Comment:** CRC is also being used for UDMC office which is an important committee of union parishad.

Ecological impacts

water quantity	decreased	✓	increased	**Comment:** The disaster resilient tube well ensures year round drinking water.
flood impacts	increased	✓	decreased	**Before SLM:** 95% families were affected by floods. **After SLM:** 47% families are affected by floods. **Comment:** The above figures are from 2016 when Bangladesh experienced one of the worst floods in recent times.

Benefits compared with establishment costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

Benefits compared with maintenance costs

Short-term returns	very negative	✓	very positive
Long-term returns	very negative	✓	very positive

CLIMATE CHANGE

Climate change/ extreme to which the Technology is exposed

How the Technology copes with these changes/ extremes

Climate-related extremes (disasters)

local rainstorm	not well at all	✓	very well
local sandstorm/ duststorm	not well at all	✓	very well
local windstorm	not well at all	✓	very well
heatwave	not well at all	✓	very well
cold wave	not well at all	✓	very well
drought	not well at all	✓	very well
general (river) flood	not well at all	✓	very well
landslide	not well at all	✓	very well

ADOPTION AND ADAPTATION

Percentage of land users in the area who have adopted the Technology

- single cases/ experimental
- 1-10%
- 10-50%
- ✓ more than 50%

Of all those who have adopted the Technology, how many have did so without receiving material incentives?

- ✓ 0-10%
- 10-50%
- 50-90%
- 90-100%

Number of households and/ or area covered

Out of a total of 8828 HHs targeted by the project, around 5000 HHs in three unions have benefitted from the implementation of the technology.

Has the Technology been modified recently to adapt to changing conditions?

- ✓ Yes
- No

Comment: A dredging machine has been used in the process of building emergency infrastructure at few sites due to unavailability of labour at the time of construction.

To which changing conditions?

- climatic change/ extremes
- changing markets
- ✓ labour availability (e.g. due to migration)

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Strengths

Land user's view

- Emergency structures are collectively owned and have a multi-purpose use; in 'normal' (non-emergency) times they are used for other purpose than safety and protection which includes community meetings, workshops and training.
- Expanded opportunities of communication during flood.

Key resource person's view

- The community is aware and driven to implement flood preparedness and risk reduction measures on its own.
- Appropriate measures can significantly change people's mindset and behaviour.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- River erosion threatens built structures. → *Careful site selection for construction work through in depth discussion with community members supported by scientific analysis.*

Key resource person's view

- High investment needed for building physical structures (e.g. CRC building) in the Chars which the local government and community find difficult to finance without external support. → *Install portable semi-permanent structures in the Chars; Lobby for greater decentralisation of finances to local government.*

REFERENCES

Compiler: Tuhin Samaddar - sidr.src@gmail.com

Resource persons: Golam Mustafa (pmdrrwash16@gmail.com) - Project Staff; Abdur Razzak (razzak.pe@gmail.com) - Project staff; Saiful Islam (saiful644@gmail.com) - Project Staff

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/technologies/view/technologies_664/

Linked SLM data: SLM Approach: Early warning message dissemination https://qcat.wocat.net/en/wocat/approaches/view/approaches_649/

Documentation was facilitated by: Swiss Red Cross - Switzerland

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Technology location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami				✓	
Mass movement	✓				
Flood	✓				
Extra tropical storm		✓			
Fog	✓				
Biological hazards					
None					
Man-made hazards					
None					
Other hazards					
Water logging	✓				
Flash flood	✓				

Vulnerability – capacity profile of the site before the Technology was applied

								Comment:
Exposure								
of people	very high/ strong	✓					very low/ non-existent	*95% of people were exposed to annual flooding.*
of private assets	very high/ strong	✓					very low/ non-existent	*Most of the private assets, around 97%, were susceptible to floods.*
of community land	very high/ strong	✓					very low/ non-existent	*In riverine islands (Chars) almost all land was exposed to flood.*
of community infrastructure	very high/ strong	✓					very low/ non-existent	*Same as above.*
Economic factors								
Access to markets	very high/ strong				✓		very low/ non-existent	*Since these are riverine islands (Chars) access to market is weak due to lack of road communication and hazardous transportation.*
Income	very high/ strong				✓		very low/ non-existent	*33% hhs had an income below 5000 taka/month which is less than $1.95 per day.*
Diversification of income	very high/ strong					✓	very low/ non-existent	*Besides agriculture, the possibility of any non-farm activity was/is negligible.*
Savings/stocks	very high/ strong				✓		very low/ non-existent	*It is largely a subsistence economy with very low savings.*
Bank savings/remittances	very high/ strong					✓	very low/ non-existent	*Linked to above explanation.*
Degree insurance coverage	very high/ strong					✓	very low/ non-existent	
Social factors								
Literacy rate	very high/ strong				✓		very low/ non-existent	*35.39% (in 2013) and 68.23% (in 2016).*
Government support	very high/ strong					✓	very low/ non-existent	*Chars are designated as "hard to reach areas" by the govt. which is an acknowledgement that govt. support is very weak.*
Family support	very high/ strong			✓			very low/ non-existent	
Community support	very high/ strong			✓			very low/ non-existent	
Access to public services	very high/ strong					✓	very low/ non-existent	*As already stated above that in "hard to reach areas" of Bangladesh access to public services is very weak.*
Physical factors								
Robustness of houses	very high/ strong				✓		very low/ non-existent	*Depending on affordability very few houses were flood resilient.*
Robustness of infrastructure	very high/ strong					✓	very low/ non-existent	*The infrastructure was very weak and even those that were there were constantly under threat of being washed away.*

Other vulnerability factors				Comment:
Open defecation	very high/ strong	☑	very low/ non-existent	*59%*
Deforestation	very high/ strong	☐	very low/ non-existent	*Data not available*
Child mortality	very high/ strong	☑	very low/ non-existent	*53 per 1000 live birth*

Damage and losses situation at the Technology sites

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☑ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1	☐ 1
☑ 2-5	☐ 2-5
☐ 6-10	☑ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☑ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☑ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☑ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10’000 USD	☐ 5001-10’000 USD
☐ 10’001-50’000 USD	☐ 10’001-50’000 USD
☑ 50’000-250’000 USD	☐ 50’000-250’000 USD
☐ > 250’000 USD	☑ > 250’000 USD

Duration since last disaster

- ☑ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Technology

Establishment of resilient emergency infrastructure (with embedded WASH systems), shelter, and access infrastructure aims to reduce people's vulnerability to floods and river erosion by creating safe living conditions in the target settlements. Emergency infrastructures follow national building codes and/or local safety norms approved by the government and are located at an elevated site that can be easily accessed by the population in the infrastructure catchment.

Type and level of DRR measures

To which DRR measure does the Technology belong?	Household	Communal	Sub-national	National	At which level does it unfold its DRR effects?
☐ Risk prevention	☐	☐	☐	☐	
☐ Disaster prevention	☐	☐	☐	☐	
☐ Disaster mitigation	☐	☐	☐	☐	
☑ Preparedness	☑	☑	☑	☐	*HHL: Reduced loss, protected livelihoods. CL: Emergency structures, such as flood shelters, schools, etc., provide safe living conditions during hazards and access infrastructure facilitates safe movement of people to these structures. SNL: National building code and local safety norms compliant Emergency infrastructure located at an elevation ensures people's safety during floods that allows sub-national govt. to invest more in preparedness rather than response.*
☐ Risk sharing	☐	☐	☐	☐	

IMPACTS

Additional benefits of the Technology

			Comment:
Safety (on-site)			
Safety of people	decreased	increased	*Before SLM: 95% families were affected from flood and after 47% families are affected from flood.*
Evacuation and shelter	decreased	increased	*Before SLM: One flood shelter that can accommodate 300 hh and after 1,803 families took shelter in 5 flood shelters and 4 primary school. Around two thousand people evacuated.*
Safety of esp. vulnerable	decreased	increased	*Before SLM: 20% of the population were especially vulnerable ad after all vulnerable people have benefitted from the technology as they are specially targeted by interventions.*
Early warning	decreased	increased	*Before SLM: No formal EWS exists and after all villages were covered through early warning dissemination. Effective EWS covered 261 clusters in 26 village.*
Economic goods (on-site)			
Safety of individual housing	decreased	increased	*Before SLM: 40% individual housing was inundated and after 91% housing are safe. 9% of house stock are not safe due to frequent river erosion.*
Safety of water stocks	decreased	increased	*Before SLM: No disaster resilient tube well existed and after All villages have access to safe source of water both in normal times and during floods.*
Safety of land assets	decreased	increased	
Safety of communal assets	decreased	increased	*Before SLM: Few roads were safe from floods and after 4 main roads and 4 wooden bridges have been built and are usable in all times.*
Other impacts (on-site)			
Health	decreased	increased	*Before SLM: Water borne diseases were very common and after these are significantly reduced. WASH intervention in all villages have led to this change.*

Off-site impacts

None



Reaching out to vulnerable communities - timely dissemination of weather forecasts (Tuhin Samaddar).

Early warning message dissemination (Bangladesh)

Bonna Purbo-Satarkabarta Prochar

DESCRIPTION

An effective system for dissemination of early warning messages was established among the vulnerable communities in the Chars (riverine sandy islands) of Gaibandha district, Bagladesh, in order to strengthen their coping mechanisms, and to reduce loss and damage caused by floods.

Early warning systems are an essential element in building resilience through effective disaster preparedness and risk mitigation: the key characteristics of the approach entail linking the intervention units at community level with national and sub-national early warning systems. It also involves developing the capacity of the local government institutions and organised communities to not only disseminate early warnings but also to effectively respond to floods. Merely installing an early warning system is not sufficient to equip communities to cope with recurrent floods; it needs to be linked to broader aspects of disaster preparedness and increased response capacity of communities and local government. The Vulnerability and Capacity Assessment (VCA) is the basis of all measures aimed at reducing disaster risks. The VCA was carried out with the involvement of local stakeholders, especially the target communities, to understand the vulnerabilities and risks associated with floods, as well as to gain insight into existing capacities and capacity gaps that needed to be addressed. The process resulted in a risk reduction action plan which was to be jointly implemented by the target community and local government. The risk reduction plan pointed to the need of having in place a mix of structural, management and contingency measures. This involved linking local, sub-national and national early warning systems, developing contingency and evacuation plans supported by the establishment of safe places where people could move during floods. The risk reduction plan also highlighted the need to support household level protection measures - structurally this meant raising household plinths above flood levels. In addition, local early warning systems were established through installation of flood markers/ pillars, and warning flags at key sites. Capacities were built to internalise, monitor and consequently respond to evolving local flood situations. Building communication channels that link the local institutions to a higher level flood forecasting system resulted in streamlining information from source to destination. The weather forecast communication now is both vertical and lateral – vertically it is a mix of web-based flood information and mobile telephony which begins at the Flood Forecast Warning Centre (FFWC) - the apex body that monitors the flood situation in Bangladesh. FFWC transmits information to the sub-national local governments that have digital centres with trained personnel who access information from the FFWC website. Trained entrepreneurs at these digital centres are responsible for monitoring flood forecasts and updating the Union Parishad (the lowest level of local body) and communities on evolving flood situation. By analysing and interpreting relevant information they play a key role in catalysing the early warning system. The local bodies, Union Parishads, use a mix of communication modes - such as miking (public address system), radio and cellular phones - to transfer early warning information to the communities. On the other hand, flood markers are installed locally that are adjusted according to increase in water levels. Designated trained persons – Youth Response Teams - take this responsibility. This is monitored by the community and the Union Parishad. In normal times, drills and simulations are conducted by trained teams of village volunteers/ first responders. They take the lead in organising evacuation and movement to safe places. The government (and project) brings in the logistical support, especially transportation, to facilitate evacuation and movement to safe places.

LOCATION



Location: Kamarjani and Mollar Char in Sadar Upazila and Haldia union in Shaghata Upazila of Gaibandha District, North-Bengal, Bangladesh

Geo-reference of selected sites

- 89.54877, 25.33119

Initiation date: 2013

Year of termination: n.a

Type of Approach

- ☑ traditional/ indigenous
- ☐ recent local initiative/ innovative
- ☑ project/ programme based

Swiss Red Cross

BANGLADESH RED CRESCENT SOCIETY BDRCS



Training on early warning message dissemination (instructor demonstrating the meaning and process of flood flaghoisting) (Saiful Islam).



Local volunteers disseminating early warning messages (Tuhin Samaddar).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

To promote resilience in communities through improved flood preparedness that reduces loss and damage of vulnerable people's lives and protects their livelihoods in the Chars of Gaibandha district.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The intervention built upon traditional coping mechanisms and indigenous systems of disaster risk management. The blending of the traditional and indigenous practices with contemporary knowledge and preparedness practices acted as drivers in terms of choice and adoption of technologies.
- **availability/ access to financial resources and services:** The DRR intervention facilitated leveraging of institutional financial resources (local government budgets) and secured cost contribution from target communities.
- **institutional setting:** The Disaster Management Act and Standing Orders on Disaster of the Govt. of Bangladesh provides for a decentralised disaster management institutional setting from the central to the local level.
- **collaboration/ coordination of actors:** The initiative built good coordination with state actors at various levels. From time to time it was also able to secure collaboration from non-state actors around specific thematic areas such as obtaining livelihood support in the non-farm sector, synergising disaster risk management work, ensuring access of vulnerable communities to social protection measures.
- **legal framework (land tenure, land and water use rights):** The Disaster Management Act, 2012 provides the legal framework for disaster risk management in Bangladesh.
- **policies:** A set of policies supports the Disaster Management Act. The government's standing orders on disaster clearly defines the roles and responsibilities of various ministries, line agencies, local govt., mandated committees and other non-state actors in disaster risk management.
- l**and governance (decision-making, implementation and enforcement):** Traditional rights to land are still accepted in Chars of Bangladesh.
- **knowledge about SLM, access to technical support:** Timely weather forecasting allows communities to time their agricultural operations, especially sowing.
- **workload, availability of manpower:** High productivity of land in Chars require less labour per unit of production in agriculture.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** In earlier phases of the intervention, the cultural norm of not abandoning one's household even in extreme crises hindered timely access to emergency infrastructure.
- **availability/ access to financial resources and services:** Lack of adequate capacities and resources within the local government.
- **institutional setting:** In principle a decentralised disaster management structure is in place but due to operational and financial constraints they are unable to perform their mandated functions.
- **collaboration/ coordination of actors:** Harmonisation of disaster centred initiatives is a time-consuming process and very often does not lead to collaboration that harnesses existing synergies.
- **policies:** Policy enforcement across sectors remains weak in Bangladesh.
- **land governance (decision-making, implementation and enforcement):** Land ownership is complex in Chars given its unstable nature due to high vulnerability to river erosion. Char lands are controlled by the local elites, often residing on the mainland, who use their political influence to secure govt. collusion/ indifference (though Char lands officially belong to them) in exercising land ownership and land transactions. Eventually it is the elites who lease and/ or rent out land to the Char population.
- **knowledge about SLM, access to technical support:** River flood erosion threats strongly disincentivise investment in SLM.
- **markets (to purchase inputs, sell products) and prices:** Market forces are yet to develop properly in Chars which are by nature isolated geographical units accessed only through time consuming and expensive transportation means.
- **workload, availability of manpower:** Disaster and higher profitability in mainland drives migration leading to labour shortages.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **community-based organisations (Village Disaster Management Committee VDMC):** The VDMC is the key actor to perform Disaster Risk Reduction activities in the communities. This covers supporting the conduct of VCA, conducted by external facilitators, by extending logistical support and securing representative participation of larger community (non-VDMC members) in the VCA process. The VCA helps VDMCs develop their action plans. The operationalisation of the plans is anchored in the VDMC and so is leveraging cooperation and collaboration from local government. The VDMC also acts as the first responder and as custodian responsible for operation and maintenance of emergency and health infrastructure. Assessing community needs, beneficiary selection, contribution collection and financial management of hardware are their other key responsibilities. Contribution collection means mediating and collecting the contribution of users/ beneficiaries and local governments to the costs of the built facilities (plinth raising, WASH, flood shelters, etc.) in pre-agreed proportions. Financial management of hardware refers to VDMCs engaging in all aspects of the construction process of small -scale communal and household mitigation options (flood shelters, roads, bridges, household plinth raising, etc.) and shouldering financial management responsibilities related to their construction and subsequent operation and maintenance. This involves managing finances (contribution from users/ LGI/ project); awarding work contracts and settlement of payment following work completion.
- **teachers/ school children/ students (Youth Response Team (YRT) members):** YRT has been developed to promote volunteerism. Their main role is to support response and recovery operations during and after disaster. They are especially trained in Search & Rescue. As they are located in the community, YRTs actively engage in early warning dissemination. They act as focal persons for monitoring and adjusting the flood markers. They support the Union Parishad in transmitting early warning to communities (as mentioned above) and supporting the evacuation of communities to safe places.
- **private sector (Enterpreneur of Union Digital Center):** The lowest level of local government, the Union Parishad (UP), has a Digital Centre to render ICT services to communities. These are run by local entrepreneurs. The entrepreneurs are responsible for monitoring flood forecasts on the internet and updating the Union Parishad (UP) and community-based organisations (CBOs) on evolving flood situation. By analysing and interpreting relevant information they play a key role in catalysing the early warning system.
- **local government (Union Disaster Management Committee (UDMC)):** The UDMC disseminates forecasts, warnings, and advice locally. It also performs a lead role in response and recovery operations.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation	Specify who was involved and describe activities
initiation/ motivation				✓		**Key Actors:** VDMC/ CBOs and Local Government Institutions (UDMC). **Activities:** Formation of CBOs, reformation of UDMC, VCA and volunteer selection.
planning				✓		**Key Actors:** VDMC/ CBOs and Local Government. **Activities:** Preparation of risk reduction action plan, preparation of evacuation plan along with map of evacuation routes (route to be taken for the evacuation in moving to safe places), contingency plan development, planning of emergency and health infrastructure, Early Warning Systems (EWS) planning.
implementation				✓		**Key Actors:** VDMC/ CBOs and Local Government. **Activities:** Establish Early Warning System, emergency infrastructure, access infrastructure (wooden bridge, roads, etc.), household infrastructure.
monitoring/ evaluation					✓	**Key Actors:** VDMC/ CBOs, Local and Sub-national Government **Activities:** Developing Quality Assurance System, Community Review Meeting, Site visits/ physical verification, quality and financial audit, survey and spot checks.
initiation					✓	**Key Actors:** VDMC/ CBOs, Local Government and Private Sector. **Activities:** O&M of built infrastructure and Sanitation Marketing which involves supporting local entrepreneurs to establish local supply chains of toilet building materials through their own investment, and build toilets for users that bear the costs. The project does not build latrines directly but rather mediates the linkages of users with the sanitation entrepreneurs.

Flow chart

The flow chart explains application of the EWS and clarifies local linkages with national flood forecasting and warning centre (FFWC).

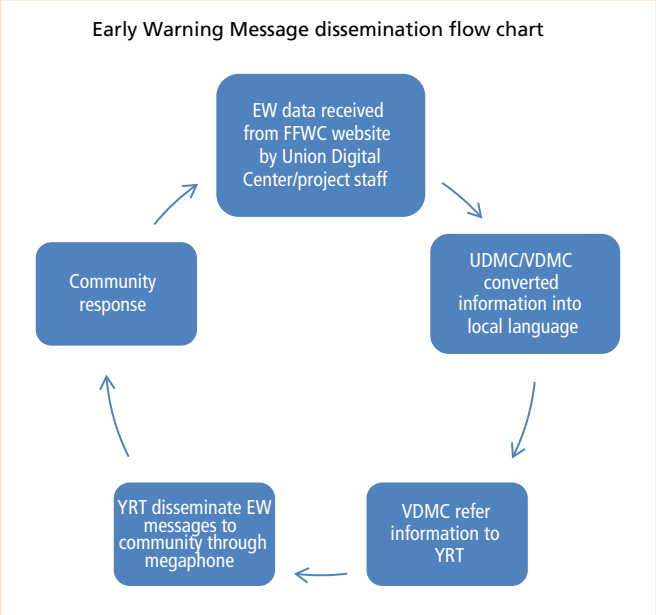


Figure: Tuhin Samaddar

Decision-making on the selection of SLM Technology

Decisions were taken by

- ☐ land users alone (self-initiative)
- ☐ mainly land users, supported by SLM specialists
- ☑ all relevant actors, as part of a participatory approach
- ☐ mainly SLM specialists, following consultation with land users
- ☐ SLM specialists alone
- ☐ politicians/ leaders

Decisions were made based on

- ☐ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- ☑ research findings
- ☑ personal experience and opinions (undocumented)
- ☑ Government policies and mandates

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ☑ Capacity building/ training
- ☑ Advisory service
- ☑ Institution strengthening (organisational development)
- ☑ Monitoring and evaluation
- ☐ Research

Capacity building/ training

Training was provided to the following stakeholders

- ☑ Capacity building/ training
- ☑ Advisory service

Form of training

- ☐ on-the-job
- ☐ farmer-to-farmer
- ☑ demonstration areas
- ☑ public meetings
- ☑ courses

Comment: 609 VDMC/ UDMC members were trained on various DRR topics. 255 local youth volunteers (YRT/ VCRP) were also trained about early warning message dissemination, flood forecast interpretation, preparing evacuation plan and route map. 4 mock drill demonstration events were conducted by the local government in which 276 community members participated. Refresher training was also organised for newly elected Union Parishad members on their broad mandate with specific reference to their roles and responsibilities in disaster risk management.

Subjects covered

Several training courses and workshops were organised on disaster preparedness and response:

1. Early Warning System (for UDMC/ VDMC/ Anser-VDP/ YRT/ VCRP/ Staff): Disaster context in Bangladesh, techniques to identify water levels against standardised danger levels, determining flood intensity by observing pillars and flags, dissemination strategies for early warning messages among the community, and role of stakeholders in warning message dissemination.
2. Evacuation Plan (for VDMC/ YRT/ VCRP): Response operation, preparing checklists for response, preparing risk and resource map, information collection and analysis, preparing evacuation route maps, and roles and responsibilities of respective stakeholders in effectuating evacuation plan.
3. Response Plan (for UDMC): Importance of response plan, key constituents of preparedness and response, interpretation of Early Warning information from FFWC, creating contingency funds, search and rescue, emergency and first aid, identifying safe exit route and transportation, damage assessment, launching a control room, involving existing manpower and resources in the community and other organisations, and positioning of rescue equipment.

Institution strengthening

Institutions have been strengthened/ established

- ☐ no
- ☐ yes, a little
- ☐ yes, moderately
- ☑ yes, greatly

at the following level

- ☑ local
- ☑ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.

- CBOs/ Village Disaster Management Committee (VDMC): on average each CBO/ VDMC has 17 members. Their roles and responsibilities entail assessments, beneficiary selection, developing and implementing Risk Reduction Action Plans (RRAPs) with a special focus on disaster preparedness and response. A key function entails their engagement in Early Warning Systems (EWS) and planning and implementation of emergency and health infrastructure, shelter protection, and creating access infrastructure. Operation and Management of all built assets and infrastructure is their responsibility.
- Local Government/ UDMC: on average it has 36 members. Standing orders on disaster of the government defines their roles and responsibilities which covers the entire gamut of functions associated with disaster risk management at the local level. Strengthening preparedness and leading effective response is critical to their mandate.

Type of support

- ☐ financial
- ☑ capacity building/ training
- ☑ equipment

Further details

Megaphones, stretchers, life jackets, life buoys, torchlights, raincoats, gumboots, ropes and first aid boxes are some of the equipment that have been given to target communities. Further, the YRTs have received whistles, umbrellas and aprons for early response operation.

Monitoring and evaluation

A joint monitoring team has been formed comprising representative of CBOs, local government and project staff.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- ☐ < 2000
- ☐ 2000-10000
- ☑ 10000-100000
- ☐ 100000-1000000
- ☐ > 1000000

Major donor: Swiss Red Cross

The following services or incentives have been provided to land users

- ☑ Financial/ material support provided to land users
- ☐ Subsidies for specific inputs
- ☐ Credit
- ☐ Other incentives or instruments

Precise annual budget: 10384 USD (amount is for the Early Warning System Implementation approach only)

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *The participation of all local stakeholders, especially women, has improved considerably.*	☐	☐	☐	☑
Did the Approach enable evidence-based decision-making? *The decision-making especially with regard to effectiveness and quality of approach and technologies has been demonstrated by the evidence on the ground.*	☐	☐	☑	☐
Did the Approach help land users to implement and maintain SLM Technologies? *Since the implementation of technologies and maintenance of built infrastructure has been largely user-led, it has improved their capacity to do the same.*	☐	☐	☐	☑
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *User contribution and govt. contribution was a mandatory component of the project which led to mobilisation of resources that supplemented project resources.*	☐	☐	☑	☐
Did the Approach improve knowledge and capacities of other stakeholders? *Implementation of well-designed capacity building plan cognisant of the needs of diverse stakeholders has improved the knowledge and capacities of relevant stakeholders.*	☐	☐	☐	☑
Did the Approach build/ strengthen institutions, collaboration between stakeholders? *The central element of the approach has been to ensure sustainability of benefits which cannot be attained without strong institutions collaborating around disaster risk management work. Thus, the approach led to improved collaboration between stakeholders and strengthened institutions.*	☐	☐	☐	☑
Did the Approach mitigate conflicts? *The approach is based on conflict sensitive programme management. This allowed for pro-active identification of conflicts and tensions followed by measures aimed at their mitigation.*	☐	☐	☑	☐

Did the Approach empower socially and economically disadvantaged groups? ✓
The extreme poor and socially disadvantaged were especially targeted by the disaster preparedness approach.

Did the Approach improve gender equality and empower women and girls? ✓
Though significant improvements are evident as women and girls are much more aware about disaster preparedness in general and flood response in particular, there remains room for further improvement.

Did the Approach lead to improved access to water and sanitation? ✓
As part of strengthening preparedness to health hazards, water and sanitation infrastructure set up by the project has greatly improved access to water and sanitation.

Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? ✓
Strengthened DRM capacities include improved climate adaptation and capacities to mitigate climate induced disasters.

Main motivation of land users to implement SLM

- increased production
- increased profit(ability), improved cost-benefit-ratio
- reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- environmental consciousness
- customs and beliefs, morals
- enhanced SLM knowledge and skills
- aesthetic improvement
- conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: The Union Digital Centre is an information hub that exists in the union where people have easy access. The technology is simple and the approach is easy to understand and has already benefited the targeted community. The anchoring of preparedness in general and Early Warning Systems (EWS) in particular in local government and its rolling out in collaboration with communities ensures a high probability of sustainability of disaster preparedness measures. During the project cycle, two flood events of significant magnitude have tested the approach and technology and resulted in tangible benefits for the community. At the same time since sustainability considerations are inbuilt in project design and have guided the implementation of the approach and technology, the likelihood of their sustainability is very strong.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- A trained group of volunteers is available in the community Response equipment is in place and ready to use if and when needed.
- Early Warning System facilitates people's timely access and movement to appropriate emergency infrastructure and protected shelters.
- Rapid evacuation, especially for the physically challenged, children and elderly people, and cattle.
- Crops are saved due to timely action related to sowing and harvesting.
- Means of preparedness, such as boats, banana rafts, portable cookers, firewood, oral rehydration solutions, dried foods can be collected beforehand.
- Balanced representation of community in government mandated disaster committees.
- Coordination/ communication with development actors and local government/ union Parishad is more forthcoming.

Key resource person's view

- Sustainability dimensions have been well considered and applied in adopted approach and technologies.
- Strengthened community institutions are in place to address disaster risk management issues, especially those related preparedness and response mechanisms.
- Community and local government interface has been strengthened to devise appropriate disaster management solutions.
- Decisions on preparedness approach and attendant technologies are taken collectively by stakeholders.
- A replicable model of early warning systems, emergency and access infrastructure has been established.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Long term maintenance of response equipment. → *UDMC should play custodian's role; local people should contribute towards recurrent cost.*

Key resource person's view

- Replicability of the model might be difficult due to lack of funds and functionaries available with local government. → *Support local government in negotiating more resources from higher levels of governance and administration; build the capacity of local government to utilise resources efficiently and effectively.*

REFERENCES

Compiler: TUHIN SAMADDAR - sidr.src@gmail.com
Resource persons: Golam Mustafa (pmdrrwash16@gmail.com) - Project staff; Abdur Razzak (razzak.pe@gmail.com) - Project staff; Saiful Islam (saiful644@gmail.com) - Project staff
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_649/
Linked SLM data: WOCAT SLM Technology: Emergency infrastructure including shelter and linked transport infrastructure https://qcat.wocat.net/en/wocat/technologies/view/technologies_664/
Documentation was facilitated by: Swiss Red Cross – Switzerland

Key references

Three VCA Reports published by UDMC with support of DRRWASH project: Bangladesh Red Crescent Society
Links to relevant information which is available online: Flood Forecasting & Warning Centre (FFWC), Bangladesh Water Development Board (BWDB), SOD: http://www.ffwc.gov.bd/#; http://ddm.portal.gov.bd/sites/default/files/files/ddm.portal.gov.bd/page/a3f4cc27_7f7d_4c2b_a1b0_166fe6bef73b/udmc.pdf

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Earthquake/Tsunami				✓	
Mass movement	✓				
Flood	✓				
Extra tropical storm		✓			
Fog	✓				
Biological hazards					
None					
Man-made hazards					
None					
Other hazards					
River Erosion	✓				
Water logging	✓				

Vulnerability – capacity profile of the site before the Approach was applied

			Comment:
Exposure			
of people	very high/ strong ✓	very low/ non-existent	*95% of people were exposed to annual flooding*
of private assets	very high/ strong ✓	very low/ non-existent	*Most of the private assets, around 97%, were susceptible to floods.*
of community land	very high/ strong ✓	very low/ non-existent	*In riverine islands (Chars), almost all land was exposed to flood.*
of community infrastructure	very high/ strong ✓	very low/ non-existent	*Same as above.*
Economic factors			
Access to markets	very high/ strong ✓	very low/ non-existent	*Since these are riverine islands (Chars) access to market is weak due to lack of road communication and hazardous transportation*
Income	very high/ strong ✓	very low/ non-existent	*33% hhs had an income below 5000 taka/month which is less than $1.95 per day*
Diversification of income	very high/ strong ✓	very low/ non-existent	*Besides agriculture, the possibility of any non-farm activity was/is negligible*
Savings/stocks	very high/ strong ✓	very low/ non-existent	*It is largely a subsistence economy with very low savings*
Bank savings/remittances	very high/ strong ✓	very low/ non-existent	*Linked to above explanation*
Degree insurance coverage	very high/ strong ✓	very low/ non-existent	
Social factors			
Literacy rate	very high/ strong ✓	very low/ non-existent	*35.39% (in 2013) and 68.23% (in 2016)*
Government support	very high/ strong ✓	very low/ non-existent	*Chars are designated as "hard to reach areas" by the govt. which is an acknowledgement that govt. support is very weak*
Family support	very high/ strong ✓	very low/ non-existent	
Community support	very high/ strong ✓	very low/ non-existent	
Access to public services	very high/ strong ✓	very low/ non-existent	*As already stated above that in "hard to reach areas" of Bangladesh access to public services is very weak*
Physical factors			
Robustness of houses	very high/ strong ✓	very low/ non-existent	*Depending on affordability very few houses were flood resilient*
Robustness of infrastructure	very high/ strong ✓	very low/ non-existent	*The infrastructure was very weak and even those that were there were constantly under threat of being washed away*

Other vulnerability factors

Open defecation	very high/ strong	☑ ☐ ☐ ☐ ☐	very low/ non-existent	*59%*
Child mortality	very high/ strong	☐ ☑ ☐ ☐ ☐	very low/ non-existent	*53 per 1000 live birth*

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☐ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☑ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1	☐ 1
☑ 2-5	☐ 2-5
☐ 6-10	☑ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☑ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☑ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☑ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☑ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10’000 USD	☐ 5001-10’000 USD
☐ 10’001-50’000 USD	☐ 10’001-50’000 USD
☑ 50’000-250’000 USD	☐ 50’000-250’000 USD
☐ > 250’000 USD	☑ > 250’000 USD

Duration since last disaster

- ☑ < 3 months
- ☐ 3-6 months
- ☐ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Approach
Early warning systems, established by the Union Disaster Management Committee with significant representation of local communities, are central to building resilience and effective disaster preparedness in order to strengthen the coping mechanism of vulnerable communities and mitigate damage/ loss caused by floods.

IMPACTS

Additional benefits of the Approach

Safety (on-site)			**Comment:**
Safety of people	decreased	increased	*Before SLM: 95% families were affected from flood and after 47% families are affected from flood.*
Evacuation and shelter	decreased	increased	*Before SLM: One flood shelter that can accommodate 300 hh and after 1,803 families took shelter in 5 flood shelter and 4 primary school. Around two thousand people evacuated.*
Safety of esp. vulnerable	decreased	increased	*Before SLM: 20% of the population were especially vulnerable and after all vulnerable people have benefitted from the technology as they are specially targeted by interventions.*
Early warning	decreased	increased	*Before SLM: No formal EWS exists and after all villages were covered through early warning dissemination. Effective EWS covered 261 clusters in 26 villages.*

Economic goods (on-site)			**Comment:**
Safety of individual housing	decreased	increased	*Before SLM: 40% individual housing was inundated and after 91% housing are safe. 9% of house stock are not safe due to frequent river erosion.*
Safety of water stocks	decreased	increased	*Before SLM: No disaster resilient tube well existed and after All villages have access to safe source of water both in normal times and during floods.*
Safety of seed/animal stocks	decreased	increased	
Safety of communal assets	decreased	increased	*Before SLM: Few roads were safe from floods and after 4 main roads and 4 wooden bridges have been built and are usable in all times.*

Off-site impacts			**Comment:**
Horizontal learning	decreased	increased	*Before SLM: At best local govt.'s efforts aimed at disaster preparedness/EWS were sporadic and rudimentary and after local govt. has plans to systematically scale up successful initiatives.*



Rice harvest (Christian Bobst).

Community safety nets - Establishment of rice seed banks at village level (Cambodia)

DESCRIPTION

A rice seed bank is a community safety net system where farmers can loan both rice seed for cultivation and rice grain for consumption from a communal storage house. The purpose is to increase their food security by guaranteeing: (1) year-round access to high quality planting material and rice for food, (2) access to both rice seed and rice for consumption after an extreme weather event (e.g. drought, flood) and (3) sustained access to improved seeds through the provision of emerging new varieties better adapted to local conditions (e.g. fast maturing, floating rice).

A rice seed bank comprises a system where farmers can get both high quality rice seeds for planting and rice for consumption from a communal storage house. The arrangement governing access to the rice bank is that farmers pay for the rice seeds or rice for food that they have been borrowed plus 20% interest after their following harvest. The bank is managed by a community council consisting of members of the village in collaboration with the local NGO Society for Community Development in Cambodia - SOFDEC. The rice banks act as a community safety net in the villages to guarantee food security despite the threat of extreme weather events such as droughts or floods. Because they now have constant access to high quality seeds, farmers can sow a second time in case the first sowing is lost due to drought or flood. Also, the communal storage of rice for consumption helps, in particular, poor farmer families with small plots in situations when they do not harvest enough to feed the household. Moreover, new rice varieties, which are better adapted to local conditions and which also perform well in the case of extreme weather (fast maturing, floating rice etc) are introduced to farmers through the bank. Furthermore these new varieties (the result of research carried out by the Local Agricultural Research and Extension Center LAREC in collaboration with other research institutes) have higher yields and can also be sold at a better price on the market. The need for a rice bank is decided in participatory manner by the village community. When a bank is established it is managed by a council of elected community members. The council is responsible for storage, distribution and it also supervises the purchases and sales. Through the collaboration between the Community Council and SOFDEC, new SLM Technologies such as the System of Rice Intensification can be promoted in the target villages. The stages of implementation are as follows: 1. SOFDEC consults with the villagers about the aim and the need for a rice bank. Generally, rice banks are established if farmers express high exposure to extreme weather event, low food security and/ or rice seeds being of poor quality (low germination, poor yields); 2. The decision about the establishment and implementation of a bank is made by the village community; 3. A Community Council is elected by the villagers and they are trained on their role and the functioning of the rice seed bank by SOFDEC staff; 4. The communal store is built: building materials are provided by SOFDEC, and the community contributes with labour; 5. SOFDEC provides the first stock of high quality rice seeds from LAREC, and rice for consumption; 6. After the first harvest, the farmers pay back the seeds and rice consumed with a 20% interest rate; 7. SOFDEC monitors the functioning of the rice seed banks and plays a mediation role in case any problems between the community council and the village community arise.

LOCATION



Location: Different districts, Kampong Chhnang, Cambodia

Geo-reference of selected sites
- 104.63912, 12.09299

Initiation date: 2000

Year of termination: n.a

Type of Approach

traditional/ indigenous
recent local initiative/ innovative
✓ project/ programme based



Rice bank next to the village hall (right of picture) (Stefan Graf).



Rice harvest (Christian Bobst).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

The main aim of the approach is to increase the resilience of farm families by improving their food security (rice seeds and rice for food are now available the whole year round, mutual support after droughts or floods is possible), increasing their income (rice varieties which are higher yielding) as well as strengthening local institutions (community committees manage the rice banks, and participate in decision making on a local level).

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** Willingness of the community to support each other through a safety-net system.
- **availability/ access to financial resources and services:** First inputs for the establishment of the rice seed banks are provided by the project (materials for the building of the bank, improved and locally adapted rice seed from LAREC).
- **collaboration/ coordination of actors:** Rice seed banks are decided upon and managed by the community itself through an elected community council.
- **knowledge about SLM, access to technical support:** Through research done by the Local Agricultural Research and Extension Centre LAREC, the rice varieties in the rice banks are adapted to the needs of the farmers (e.g. higher yielding, rapid maturity, drought resistant). Through the SOFDEC programme farmers are furthermore capacitated in new cultivation techniques (such as the "System of Rice Intensification"- SRI).

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** Some farmers are reluctant to be part of the bank, as they do not want to use/consume someone else's rice, which might be of different quality than their own.
- **availability/ access to financial resources and services:** Some farmers struggle to repay the amount of rice borrowed which includes an interest rate of 20%, particularly after an extreme weather event (drought, flood, etc.).
- **knowledge about SLM, access to technical support:** Lack of technical knowledge on high quality seed multiplication leads to rice seed of poor quality in the rice bank.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (farmers):** Farmers can borrow rice seed and in case of a disaster rice for consumption from the rice bank. After their next harvest the farmers have to pay back the rice (seed) borrowed plus 20% interest.
- **community-based organisations (Community council):** Community Councils are elected by the community and manage the rice banks making sure that the regulations are met by the farmers participating in the rice banks.
- **NGO (Society for Community Development in Cambodia - SOFDEC):** SOFDEC is responsible for the planning and design of the approach, implementation of rice banks as well as for the financing of the initial establishment of the banks.
- **local government (village chief):** The village chief facilitates the introduction of the rice seed bank in the community and supports the community council in the steering of the banks, as well as when facing problems within the village concerning the bank. Furthermore, the village chief has to verify and acknowledge land acquisition documents land for rice bank construction and by-laws.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning		✓			
implementation			✓		
monitoring/ evaluation				✓	
research		✓			

Specify who was involved and describe activities

Land users are consulted regarding their needs for the establishment of a rice bank.

The planning and design of the rice banks is carried out by SOFDEC staff.

Implementation of the banks is done by SOFDEC in consultation with the land users. SOFDEC finances the materials for the establishment of the rice banks, while the community contributes with their labour. Community agrees on the regulations (by-laws) for the management of the rice banks.

SOFDEC initially monitors the functioning of the rice banks (3-4 years after establishment). The community council is responsible for the everyday monitoring of the banks (e.g. participating farmers adhere to the regulations agreed on by the community).

Research for improved locally adapted rice varieties (fast maturing, floating rice etc.) is done by Local Agricultural Research and Extension Center (LAREC) in collaboration with other research institutions. The improved seed developed by LAREC is stocked in the rice seed banks.

Flow chart

Rice seed banks are established at the village level after consultation with the local farming community. The banks are managed by an elected community council. Farmers borrow rice seed or rice for consumption (in case of an emergency) and pay back the amount plus 20% interest. SOFDEC facilitates the establishment of the rice banks and provides the material for the building of the bank as well as the first supply of rice seed.

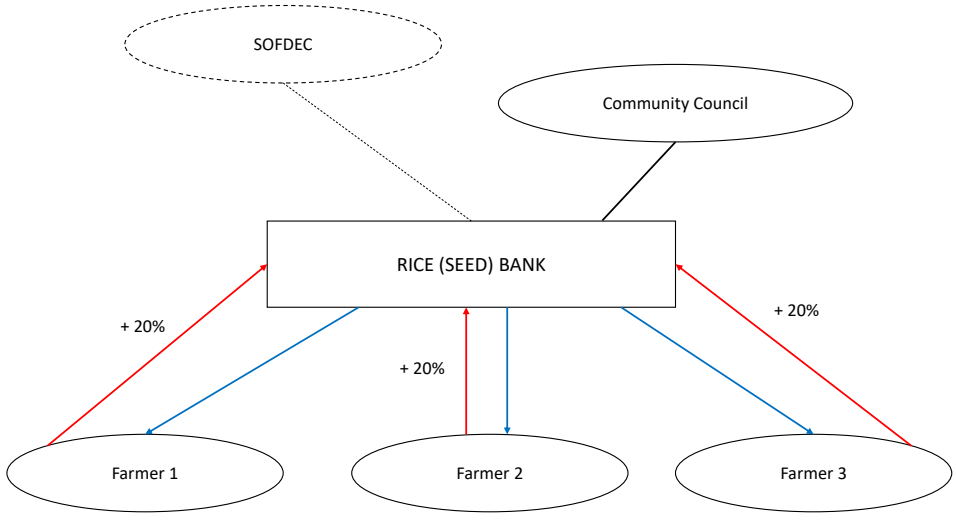


Figure: HEKS

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- ✓ mainly land users, supported by SLM specialists
- all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

n.a.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE

The following activities or services have been part of the approach

- ✓ Capacity building/ training
- ✓ Advisory service
- ✓ Institution strengthening (organisational development)
- ✓ Monitoring and evaluation
- Research

Capacity building/ training

Training was provided to the following stakeholders
- [x] land users
- [ ] field staff/ advisers

Form of training
- [x] on-the-job
- [ ] farmer-to-farmer
- [ ] demonstration areas
- [ ] public meetings
- [ ] courses

Subjects covered
Community councils were trained on functioning and administration of the rice bank. Farmers were trained on the multiplication and collection of rice seeds.

Advisory service

Advisory service was provided
- [ ] on land users' fields
- [ ] at permanent centres

Comment: Knowledge exchange between the land users and SOFDEC staff. Knowledge exchange between SOFDEC and the Provincial Department of Agriculture.

Institution strengthening

Institutions have been strengthened/ established
- [ ] no
- [ ] yes, a little
- [x] yes, moderately
- [ ] yes, greatly

at the following level
- [x] local
- [ ] regional
- [ ] national

Describe institution, roles and responsibilities, members, etc.
Community Councils

Type of support
- [ ] financial
- [x] capacity building/ training
- [ ] equipment

Monitoring and evaluation
Everyday monitoring is ensured by the community council. For the first 3-4 years after establishment, SOFDEC monitors the implementation and functioning of the rice banks. Monitoring aspects: - No. of members, kg of rice taken out of the bank and money paid back to the bank - General attitude towards the rice bank (whether the payback mechanisms are adhered to, etc.) - Amount of yields and quality of rice (seeds), sometimes optimised.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component
- [ ] < 2000
- [x] 2000-10000
- [ ] 10000-100000
- [ ] 100000-1000000
- [ ] > 1000000

Precise annual budget: n.a.

The following services or incentives have been provided to land users
- [x] Financial/ material support provided to land users
- [x] Subsidies for specific inputs
- [ ] Credit
- [ ] Other incentives or instruments

Financial/ material support provided to land users
The project provides the materials for rice bank construction.

Subsidies for specific inputs (including labour)

Labour by land users was
- [x] voluntary
- [ ] food-for-work
- [ ] paid in cash
- [ ] rewarded with other material support

Comment: Land users supported the establishment of the rice seed banks with their labour.

	partly financed	fully financed
agricultural: seeds *Rice seeds for the first season after the implementation of the rice bank is provided by the project.*	☐	☑
construction: stone *All construction materials for the rice bank building are provided by the project. Type of construction (wood or stone) varied depending on the preferences of the village community.*	☐	☑
construction: wood *as above (for stone)*	☐	☑

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

DEAL WITH

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach help land users to implement and maintain SLM Technologies? *Farmers have access to seed varieties which are adapted to local conditions (e.g. drought and flood resistance), ensuring yields even in cases of extreme weather event.*			✓	
Did the Approach empower socially and economically disadvantaged groups? *Rice seed banks are open to everybody. Thus, economically disadvantaged land users and ethnic minorities participate. The rice banks function as safety nets in cases of extreme weather (e.g. droughts, floods) or economic despair.*			✓	
Did the Approach lead to improved food security/ improved nutrition? *The rice banks offer year round access to high quality rice seed and rice for consumption all year and also during extreme weather events. This allows farmers to sow again in case one harvest gets lost. The rice bank also benefits farmers with small land plots – they might sell all their yields of new varieties on the market and buy, with their improved income, conventional rice for consumption, which is cheaper.*				✓
Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? *Increased resilience to extreme weather events because of the availability of both seeds and rice for consumption. Moreover, the seed varieties stored in the rice bank is adapted to local conditions (e.g. fast maturing, floating rice), ensuring some harvest even with extreme weather events.*				✓
Did the Approach lead to employment, income opportunities? *The new varieties promoted through the rice banks produce higher yields, leading to more income for farmers. Farmers also get higher prices on the market for the new rice varieties.*			✓	

Main motivation of land users to implement SLM

- ✓ increased production
- increased profit(ability), improved cost-benefit-ratio
- reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- environmental consciousness
- customs and beliefs, morals
- enhanced SLM knowledge and skills
- aesthetic improvement
- conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: Initial coaching by SOFDEC is needed, however, after 3 years the rice banks function without any external support.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- The rice banks offer access to high quality seeds to all farmers in the community.
- Increased food security and resilience due to the permanent availability of rice seeds or rice for consumption.
- More income due to higher yields and better prices for new varieties.
- After about 3-4 years, the banks mostly work independently.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Limited amount of rice to be borrowed. → *Increase the storage capacity and conditions.*
- Required technical and managerial knowledge for the community councils is high. → *Regular training sessions by SOFDEC.*
- Rodents or insects might destroy the rice. → *Apply narrow-mesh nets to protect the rice from rodents and other animals.*
- Some farmers do not comply with the required interest rates, delays in payback, etc. → *Make a contract with them, decide on a step by step pay back mechanism, or if the farmer is not able repay (sick family member, loss of land, etc.) the whole group can decide to waive the debts.*

Key resource person's view

- Seeds are treated with pesticides to make them last. → *Improve the storage conditions or use different techniques to prevent pests (Integrated Pest Management IPM).*
- Only rice is considered. → *Introduce a similar approach also for other crops in order to diversify the farmers' income. Allow the farmer to pay back with other crops or varieties.*

REFERENCES

Compiler: Judith Macchi - judith.macchi@heks.ch
Resource persons: Lean Hak Khun (kleanghak@yahoo.com) - SLM specialist; Sreytouch Bin - SLM specialist; Mesa Say Khonhel Pit - SLM specialist
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_1848
Documentation was facilitated by: HEKS/ EPER

Links to relevant information which is available online
The Society for Community Development in Cambodia (SOFDEC) www.sofdec.com

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood		✓			
Drought		✓			
Biological hazards					
Insect infestation		✓			
Man-made hazards					
None					
Other hazards					
Thunder	✓				

Vulnerability – capacity profile of the site before the Approach was applied

							Comments:
Exposure							
of people	very high/ strong	✓				very low/ non-existent	*Low capacity and lack of mechanism to cope with any hazard, especially flood and drought.*
of private assets	very high/ strong	✓				very low/ non-existent	
of community land	very high/ strong	✓				very low/ non-existent	
of community infrastructure	very high/ strong	✓				very low/ non-existent	*Poor infrastructure especially drainage and irrigation system (pond, dam and canal).*
Economic factors							
Access to markets	very high/ strong			✓		very low/ non-existent	*Difficult market access for local products. The price of product depends on middleman and buyers.*
Income	very high/ strong			✓		very low/ non-existent	*Low income from livelihood activities especially agriculture activity.*
Diversification of income	very high/ strong			✓		very low/ non-existent	*Rice cultivation is the main source of income, garment factories and other off-farm activies is second. Moreover, some farmers depend on livestock raising, vegetable growing and cash crop.*
Savings/stocks	very high/ strong			✓		very low/ non-existent	
Bank savings/remittances	very high/ strong			✓		very low/ non-existent	*Majority of farmers have no bank saving but some have remittances from relatives working in the garment factory sector.*
Degree insurance coverage	very high/ strong				✓	very low/ non-existent	
Social factors							
Literacy rate	very high/ strong			✓		very low/ non-existent	
Government support	very high/ strong			✓		very low/ non-existent	*Low support from government only in case of an emergency, not for prevention and preparedness activities.*
Family support	very high/ strong			✓		very low/ non-existent	
Community support	very high/ strong			✓		very low/ non-existent	*In the community, less fund/capital for supporting vulnerable group especially elder person/ID poor.*
Access to public services	very high/ strong			✓		very low/ non-existent	
Physical factors							
Robustness of houses	very high/ strong			✓		very low/ non-existent	*Houses are built with bamboo and palm leaf, so not flood or storm resistant.*
Robustness of infrastructure	very high/ strong			✓		very low/ non-existent	

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- [ ] substantial increase in losses
- [x] some increase in losses
- [ ] no change
- [ ] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1	[ ] 1
[x] 2-5	[ ] 2-5
[ ] 6-10	[ ] 6-10
[ ] 11-50	[x] 11-50
[ ] > 50	[ ] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[ ] 11-50	[ ] 11-50
[ ] 51-100	[ ] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[x] > 500	[x] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[x] 1-20%	[ ] 1-20%
[ ] 21-50%	[x] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[ ] 21-50%	[ ] 21-50%
[x] 51-80%	[x] 51-80%
[ ] 80-100%	[ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[ ] 0 USD	[ ] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[ ] 1001-5000 USD	[ ] 1001-5000 USD
[ ] 5001-10'000 USD	[ ] 5001-10'000 USD
[ ] 10'001-50'000 USD	[ ] 10'001-50'000 USD
[x] 50'000-250'000 USD	[ ] 50'000-250'000 USD
[ ] > 250'000 USD	[x] > 250'000 USD

Duration since last disaster

- [ ] < 3 months
- [x] 3-6 months
- [ ] 7-12 months
- [ ] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Approach

To increase the resilience of farmers by improving access to (1) year-round access to high quality locally adapted rice seeds, and (2) improved quality of the planted seeds through the provision of new varieties, which eventually leads to increased yields and income.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased	increased
Safety of esp. vulnerable	decreased	increased

Economic goods (on-site)

Safety of seed/animal stocks	decreased	increased

Off-site impacts

None



Producers: the group that benefits most from Comprehensive Agrarian Risk Management (PROFIN).

Comprehensive Agrarian Risk Management (GRAI) (Plurinational State of Bolivia)

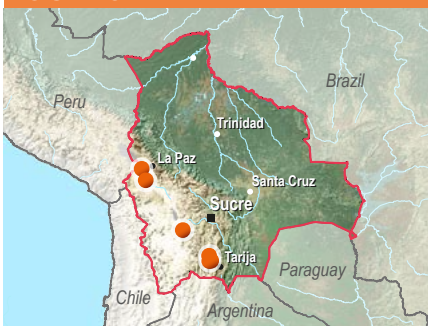
Gestión del Riesgo Agrícola Integral (GRAI)

DESCRIPTION

The purpose of the approach is to address disaster risks and climate extremes through the Comprehensive Agrarian Risk Management service (GRAI: Gestión del Riesgo Agrícola Integral), tailored to the needs of small rural producers. It includes measures for prevention, mitigation, preparedness and risk transfer in order to create resilience against natural disasters. Good practices for agrarian producers were promoted, while financial mechanisms for risk transfer were identified through a form of insurance and were matched to the needs of rural producers.

The implementation of Comprehensive Agrarian Risk Management (GRAI) is based on two pillars: (i) Agroclimatic Risk Management (GRAC: Gestión del Riesgo Agroclimático) to implement productive strategies suited to the local context in order to reduce the risk of crop losses, and (ii) Agrarian Financial Risk Management (GRAF: Gestión del Riesgo Agrícola Financiera) to develop products and mechanisms of risk transfer to compensate producers for economic loss, based on prevention, preparation and response measures. The purpose of the approach is to promote a combination of different sustainable measures and mechanisms for agrarian producers, through improving the capacity of local actors (communities and municipalities) to respond to, prevent and mitigate risk. The methods are two. Firstly, field practice, and transfer of local competence under GRAC. Support was provided to implement and disseminate agroecological practices that are simple and easily replicated, and which are tailored to the needs and abilities of producers - but also recognise ancestral knowledge. Secondly, financial risk transfer mechanisms through GRAF. Pilot financial insurance mechanisms were designed and implemented for the most important crops in the area (potatoes, quinoa, grapes, and peaches). Producers access the fund by paying a premium. This provides indemnity in case they are affected or overwhelmed by a disaster. In other words, in case of a climate extreme (hail, frost, drought or excess rain), the damage to affected crops is assessed by an expert; this assessment is performed using a predefined and known methodology by a trained local expert ("Yapuchiri") during field visits. Implementation took place between February 2011 and March 2014. It started with pilot models and measures. The stakeholders involved were (a) Supramunicipal partners (i.e. associations of municipalities: Aymaras Sin Fronteras, Azanaque, Cintis, Andean Region of Cochabamba - Jacha Suyu Pakajaqi Indigenous Peasant Organisation, and Federations of Associations of Producer Unions of the Bolivian Altiplano; (b) Partners at the national level: Ministry of Rural Development and Land (Ministerio de Desarrollo Rural y Tierras, MDRyT), Vice-Ministry of Rural and Agricultural Development (Viceministerio de Desarrollor Rural y Agropecuario, VDRA), Agropecuarian and Climate Change Risk Management Unit (Unidad de Gestión del Riesgo Agropecuario y Cambio Climático, UGRACC) which works in the context of GRAC, and MDRyT with the Agrarian Insurance institute (Instituto del Seguro Agrario, INSA), in the context of GRAF. Land users enjoyed the learning process, and appreciated agricultural risk transfer mechanisms tailored to the conditions and needs of small rural producers. The combination of different mechanisms and measures to reduce and manage risk allows the producers to choose the most relevant measures for their needs.

LOCATION



Location: Location: In the valley and highland areas of the Department of Chuquisaca, La Paz, Potosi, Oruro and Cochabamba, Plurinational State of Bolivia

Geo-reference of selected sites

- -65.28316, -21.03021
- -65.27767, -20.99817
- -65.24162, -21.19337
- -68.46714, -17.17884
- -68.69455, -16.54795
- -66.61783, -19.7024

Initiation date: 2011

Year of termination: 2014

Type of Approach

- traditional/ indigenous
- ✓ recent local initiative/ innovative
- project/ programme based



Producers in the Municipality of Huarina, Department of La Paz, sharing GRAC practices such as potato crop assessment (PROSUCO).



Producers in the Municipality of Batallas, Department of La Paz, during the potato harvest (Altiplano, PROSUCO).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Implement sustainable agrarian risk transfer mechanisms for agricultural producers, based on their needs for protection against climate risks, and to enhance their resilience to natural disasters.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** The socio-productive conditions of the communities are based on cultural values such as reciprocity and complementarity; these allow implementing and transferring local practices through sharing experience, knowledge and indigenous knowledge.
- **availability/ access to financial resources and services:** The state encourages financial institutions to develop mechanisms allowing small agricultural producers to access loans on better terms.
- **institutional setting:** The Agrarian Insurance Institute (INSA) is a well established and important partner institution that is crucial to implementing financial risk transfer mechanisms under GRAF. It allows producers to gain indemnity without paying premiums. This is made possible through government subsidies granted by the Bolivian State. The government, through INSA, also promotes the development of non-financial mechanisms by implementing good practices, such as the use of certified seeds.
- **collaboration/ coordination of actors:** A producer organisation, FUNAPA (Federación de Unión de Asociación de Productores del Altiplano) has considerable experience in the field of indigenous knowledge and practices, including work with centres for organic bioinputs and agroclimatic monitoring centres with the participation of municipalities.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **legal framework (land tenure, land and water use rights):** Law 393 for Financial Services, issued in 2013, created conditions for financial institutions to develop mechanisms that allow small rural area producers to access loans under better terms. Producers have property titles and their lands are registered as legal property. Local institutions in charge of managing and using water as a public good for producers were established.
- **policies:** Law 144 for Productive, Community and Agropecuniary Revolution was issued. It created the Agrarian Insurance Institute (INSA) and promotes the development of strategies at the national and subnational level that include risk management for agrarian production and organic production, and 'respect and care for Mother Earth'.
- **land governance (decision-making, implementation and enforcement):** With the support of Law 144, producers can assume a leading role. In other words, they can make certain decisions and actions at the local level when consensus is reached with other producers and local authorities.
- **knowledge about SLM, access to technical support:** Traditional sustainable agroproductive practices are recognised as valid once again. This is seen in the recovery and documentation of ancestral knowledge to predict weather based on bio-indicators; these indicators are recorded in a log book known as "Pachagrama". Another practice involves using organic biofertilizers manufactured by the producers, as well as damage and accident assessment of crops, carried out by the producers themselves.
- **markets (to purchase inputs, sell products) and prices:** Market opportunities are created for producers. For example, certified potatoes and seeds are sold to governmental or non-governmental institutions. Furthermore, quinoa producers were enabled to access fair trade, and obtained the Fairtrade label.
- **workload, availability of manpower:** Family labour was provided to build minor infrastructure, such as the centres for organic inputs. The participation of families has been acknowledged as project counterpart contribution from the stakeholders.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities:** Farmers, i.e. small agrarian producers who represent the main economic activity of the area. They produce subsistence crops. Stakeholders implement agrarian practices and measures. They help in the documentation efforts and to re-evaluate and recognise local knowledge. They learn the importance of having agrarian insurance.
- **community-based organisations:** Local authorities, Indigenous Peasant Organisation Jacha Suyu Pakajaqi (Organización Indígena Originario Campesino Jacha Suyu Pakajaqi) and the Federation of the Union of Producer Associations of the Altiplano. Support of agricultural initiatives involving good farming practices and the Risk Transfer Fund.
- **SLM specialists/ agricultural advisers (leading farmers or "Yapuchiri"):** Potato, quinoa, grape and peach crops are the most important in the area. Pilot financial insurance mechanisms were designed and implemented for these crops and included in the Agrarian Risk Transfer Fund. Producers access the fund by first paying a premium providing them with insurance in case of climate extremes such as hail, frost, drought or excessive rains. In the case of a weather extreme, an expert assesses the damage to affected crops, following a predefined and approved method. The expert is a trained local leader known as "Yapuchiri", who performs the assessment through field visits. The Yapuchiri also monitors the operation of the transfer fund at the local level, i.e. the compensation for damage the producers have suffered.
- **teachers/ school children/ students**
- **NGOs: HELVETAS Swiss Intercooperation (Project to Reduce Disaster Risks), PROSUCO (Asociación Promoción de la Sustentabilidad y Conocimientos Compartidos, i.e. Association to Promote Sustainability and Shared Knowledge), PROFIN (Fundación para el Desarrollo Productivo y Financiero, i.e. Foundation for Productive and Financial Development):** Project management, coordination and monitoring. Support to discuss issues. Development of capacities at the national and subnational level. Design and development of financial and non financial mechanisms for risk transfer.
- **local government (Authorities from municipal governments):** Promotion and implementation of policies for risk transfer mechanisms to be set in place. Integration of risk management in the institutions and processes carried out in municipalities, such as development plans and budget planning.
- **national government (planners, decision-makers):** INSA, Vice-Ministry of Rural Development and Land. Legal and institutional framework to support agrarian producers by providing them with protection for their production and livelihoods in the case of climate extremes. Development and implementation of risk transfer mechanisms. Creation of favourable conditions that foster democracy, equity and inclusion, that respect local-indigenous uses and customs.
- **International organisation: Swiss government through Swiss Cooperation in Bolivia (COSUDE):** Project funding.

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation	Specify who was involved and describe activities
initiation/ motivation					✓	Agrarian producers are aware, are motivated and possess knowledge required to 'revalue' local and ancestral knowledge to manage agricultural risk.
planning				✓		Agricultural producers interact with their matrix organisation and municipal government for planning. They are supported by PROSUCO, PROFIN and HELVETAS.
implementation				✓		Agricultural producers contribute family labour to build microfacilities, such as centres where organic inputs are produced.
monitoring/ evaluation				✓		PROSUCO and PROFIN, as implementation partners, have put in place a monitoring system, in close cooperation with partner institutions and beneficiaries (farmers) to monitor the effects.
capitalizing from the experience				✓		Exchange was an important aspect of the project, as well as capitalising on and documenting the experience. This was organised through field visits, events, fairs and publishing material with the help of diverse actors (INSA, associations, PROSUCO, PROFIN etc.).

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- ✓ mainly land users, supported by SLM specialists
- all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- ✓ evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- personal experience and opinions (undocumented)

Comment: Agricultural producers were supported by other leading organisations, such as "Kamayoc" from Peru, field schools from Nicaragua and project specialists, i.e. NGOs, and PROSUCO for technological innovation, and PROFIN for microfinancial services.

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE

The following activities or services have been part of the approach

- ☑ Capacity building/ training
- ☑ Advisory service
- ☑ Institution strengthening (organisational development)
- ☑ Monitoring and evaluation
- ☐ Research

Capacity building/ training

Training was provided to the following stakeholders

- ☑ land users
- ☑ field staff/ advisers

Form of training

- ☐ on-the-job
- ☑ farmer-to-farmer
- ☑ demonstration areas
- ☑ public meetings
- ☑ courses

Subjects covered

Sustainable practices were taught in the non-financial component (GRAC). These practices included the manufacturing of organic inputs such as ecological fertilizers, and natural insect repellents.

In the financial domain (GRAF), training on financial risk transfer mechanisms was provided; also, participants were briefed on the operation and advantages of the Risk Transfer Funds.

Advisory service

Advisory service was provided

- ☑ on land users' fields
- ☐ at permanent centres

Comment: The support and assessment of good practices was passed on from producer to producer. The Yapuchiri, producers in a leadership position, must have an important role and exchange information with their counterparts from Peru ("Kamayoc"). PROSUCO provided farmers with support for technological innovation and from PROFIN to learn about financial services.

Institution strengthening

Institutions have been strengthened/ established

- ☐ no
- ☐ yes, a little
- ☐ yes, moderately
- ☑ yes, greatly

at the following level

- ☑ local
- ☐ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.

Federation of Producer Association Unions from the Altiplano (Federación de Unión de Asociaciones Productivas del Altiplano). This institution brings together potato growers from the Altiplano region and helps its member organisations to strengthen their capacities.

The Indigenous Peasant Organisation Jacha Suyu Pakajaqi brings together communities and promotes development within them. Producer organisations from the CINTIS region.

Type of support

- ☑ financial
- ☑ capacity building/ training
- ☐ equipment

Further details

Capacities were developed through partners such as PROSUCO. Financial mechanisms were designed and adjusted in the frame of the Risk Transference Funds.

Monitoring and evaluation

Financial insurance mechanisms were designed for the most common crops (potatoes, quinoa, grapes, peaches) in the framework of the Agrarian Risk Transference Funds. When an extreme weather event takes place (hail, frost or drought), a technical assessment is carried out on the affected croplands. The assessment uses a predefined and familiar methodology, and is carried out by a local leader, a producer who has been properly trained to do so, the "Yapuchiri". He performs the assessment through field visits. Furthermore, the Yapuchiri monitors the operation of the transfer fund at the local level, i.e. the compensation provided according to the damage suffered. INSA (Agrarian Insurance Institute) monitors all reported events and insurance claims at the national level. All these mechanisms together ensure monitoring of the financial mechanisms at the local and national level. This aspect is in the domain of GRAF.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- ☐ < 2000
- ☐ 2000-10000
- ☐ 10000-100000
- ☑ 100000-1000000
- ☐ > 1000000

Value refers to the entire project to reduce climate extreme risks.

Precise annual budget: n.a.

The following services or incentives have been provided to land users

- ☑ Financial/ material support provided to land users
- ☑ Subsidies for specific inputs
- ☐ Credit
- ☑ Other incentives or instruments

Financial/ material support provided to land users

Producers received basic inputs to implement good practices (e.g. containers and agrofilm to produce biofertilizers, etc.).

Subsidies for specific inputs (including labour)

Labour by land users was

- [x] voluntary
- [ ] food-for-work
- [ ] paid in cash
- [ ] rewarded with other material support

DEAL WITH

	partly financed	fully financed
agricultural: fertilizers *Basic input to produce mineral mixtures, biofertilizers*		✓

Other incentives or instruments

An Agrarian Risk Transfer Fund (agricultural microinsurance) was set up as a financial mechanism aimed at producers of potatoes, grapes and peaches with resources from the Project to Reduce Climate Extremes Risks from Swiss Cooperation, implemented by HELVETAS Swiss Intercooperation, with the support of PROFIN. Producers accessed the fund through a payment that allowed them to receive indemnity in case they were affected by an extreme climatic event (hail, drought, frost or excessive rain).

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach empower local land users, improve stakeholder participation? *We observed that local knowledge was widely reassesed for its value. For example, bio-indicators were being used for local weather forecasting. We also saw that good practices were put in to effect (e.g. people used organic fertilizers). Producers know and are aware of the relevance of the Risk Transfer Fund.*				✓
Did the Approach enable evidence-based decision-making? *The learning-by-doing methodology was promoted based on the evidence provided from the experiences shared by local promoters, the "Yapuchiris", farmers from FUNAPA, and by non-financial interventions (GRAC). One of the most important practices is the local agroclimate weather forecast based on bio-indicators monitored and documented in a logbook known as "Pachagrama". Another example is the creation and operation of centres for organic inputs to provide biofertilizers for producers from the involved communities. There are also financial interventions through GRAF, and damage assessment to grape, peach, potato and quinoa crops assessed by trained farmers/ local experts. All the products and mechanisms involved in the approach were developed with the participation of farmers and experts. Thus, these methods and results are considered relevant for decision-making.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *The results of good agrarian practices show a good cost-benefit ratio: producers indicated that losses in the annual potato yield were reduced by over 50%. Potato crop yields increased between 67% to 144% compared to the average national yield, and local yield averages of potato growers not covered in the project. Grape and peach farmers were able to reduce losses by 25 to 30% (Source: SERIES Consolidación, GRAI, 2014).*			✓	
Did the Approach improve coordination and cost-effective implementation of SLM? *Farmers learned about the importance of comprehensive management of Disaster Risk Reduction by using prevention, mitigation and risk transfer measures.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *i) The experience in the financial domain (GRAF) allowed government partners (INSA) to set the bases of the financial component to implement the agricultural insurance. Afterwards, the insurance expanded its coverage to include more crops: potato, quinoa, wheat, fava beans, barley, alfalfa, corn and lentils (Source: Ministry of Rural Development and Land and INSA, 2016). ii) The non-financial component (GRAC) promoted the implementation of comprehensive and complementary agricultural risk management strategies for prevention, mitigation and primary productive response. These measures are managed and implemented by local actors and municipal, departmental and national institutions, using agroclimatic maps, community centres for organic inputs and agroclimatic forecasts ("Pachagrama")*			✓	
Did the Approach empower socially and economically disadvantaged groups? *The financial component (GRAF) provided access to insurance for people who had none before. Implementing good practices has benefitted producers who lacked the technology to improve their performance and access to market.*			✓	
Did the Approach encourage young people/ the next generation of land users to engage in SLM? *Knowledge management (training, workshops, sharing experiences) on the field (farm plots) enabled women, young people and children to participate in the activities involved in the approach. Knowledge management is in the hands of experts with diverse expertise. Furthermore, this is an example for the communities' younger generations, who will grow up knowing they can become good producers thanks to the varied strategies they can use to manage risks and adapt to climate change.*			✓	
Did the Approach lead to improved food security/ improved nutrition? *In areas where the project was implemented, the yield of potato crops increased over 100 %, and by 25% in fruit crops such as grapes and peaches. This is very important, since most of the farmers are small subsistence growers.*				✓

Did the Approach lead to more sustainable use/ sources of energy? ☑

Biodigesters were built which can be used to manufacture liquid fertilizers and also to cook food. All the biofertilizers that are manufactured and promoted make use of recycling and reusing locally available materials that are usually discarded (hay stubble, grass, guano) to manufacture organic fertilizers. This provides an alternative to chemical fertilizers, which involve high energy use for their production.

Did the Approach improve the capacity of the land users to adapt to climate changes/ extremes and mitigate climate related disasters? ☑

The purpose of the measures involved allow small farmers to address climate change. Producers developed capacities in deploying agroecological measurers for risk prevention and mitigation and adaptation to climate change. This approach also includes measures to manage risks when planning agricultural production, such as local weather forecasting using bio-indicators, and the use of organic fertilizers as response measures. By recovering ancestral knowledge used for forecasting and monitoring the weather, the stakeholders can forecast rainy seasons and the intensity of hail or frost.

Main motivation of land users to implement SLM

- ☐ increased production
- ☑ increased profit(ability), improved cost-benefit-ratio
- ☐ reduced land degradation
- ☑ reduced risk of disasters
- ☐ reduced workload
- ☐ payments/ subsidies
- ☐ rules and regulations (fines)/ enforcement
- ☐ prestige, social pressure/ social cohesion
- ☐ affiliation to movement/ project/ group/ networks
- ☐ environmental consciousness
- ☐ customs and beliefs, morals
- ☑ enhanced SLM knowledge and skills
- ☐ aesthetic improvement
- ☐ conflict mitigation

Sustainability of Approach activities

Can the land users sustain what had been implemented through the Approach (without external support)?

- ☐ no
- ☑ yes
- ☐ uncertain

Comment: Good agricultural practices are replicated using a model involving knowledge transfer from producer to producer. The practices involved have a strong sustainability approach; they are easy to put into practice and have low implementation costs, thus they are easily replicated. They are taught through 'learning-by-doing' and promote local leadership. Also, they promote articulation and cooperation at different government levels (community, municipality, and ministries). It is evident that financial mechanisms require support from specialized financial institutions with significant presence in rural areas.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view

- The combination of different mechanisms and measures to reduce and manage risk allow the producers to choose from a variety of measures to find those most relevant to address his needs.
- Promoting and disseminating good agroecological practices that can be used for risk prevention, mitigation and adaptation, by including these in the process of agricultural production.

Key resource person's view

- The approach combines financial and non-financial mechanisms to reduce and manage risks by collaborating with diverse institutions and actors, allowing the establishment of financial and non-financial mechanisms to replicate and develop further examples that can be valuable for INSA. The approach further generates financial and non-financial mechanisms to transfer risks; this is an important message to INSA to take up other inspiring ideas that can be replicated and further developed.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view

- Financial mechanisms need specialised institutions present in rural areas.→ *Municipal governments must generate conditions and create alliances with financial entities to promote financial mechanisms that can be used to transfer risks.*

REFERENCES

Compiler: Marco Loma - marco.loma@helvetas.org

Resource persons: Maria Quispe (info@prosuco.org) - PROSUCO (project designer); Edwin Vargas (fundacionpro n@fundacion-pro n.org) - PROFIN (programme designer); Oscar Paz (oscar.paz@helvetas.org) - Helvetas

Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_693/

Documentation was facilitated by: HELVETAS (Swiss Intercooperation)

Key references

Consolidación de la Gestión del Riesgo Agrícola Integral (GRAI), PROSUCO-PROFIN-Helvetas-COSUDE, 2014: http://www.rrd.com.bo/wp-content/uploads/2015/publi_fases/fase_03/19PROS.pdf

Links to relevant information which is available online

programa de reducción del riesgo de desastres (PRRD), Helvetas, COSUDE Bolivia, colecion de todas las publicaciones del proyecto: http://www.rrd.com.bo

PachaGrama agroclimate logbook, MDRyT and PRRD partners, 2012: http://www.rrd.com.bo/wp- content/uploads/2015/publi_fases/fase_03/07pachagrama2br.pdf

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood			☑		
Landslide		☑			
Convective storm	☑				
Extreme Temperature		☑			
Drought		☑			
Biological hazards					
None					
Man-made hazards					
Pollution	☑				

Vulnerability – capacity profile of the site before the Approach was applied

Exposure						
of people	very high/ strong		☑			very low/ non-existent
of private assets	very high/ strong			☑		very low/ non-existent
of community land	very high/ strong		☑			very low/ non-existent
of community infrastructure	very high/ strong			☑		very low/ non-existent
Economic factors						
Access to markets	very high/ strong				☑	very low/ non-existent
Income	very high/ strong				☑	very low/ non-existent
Diversification of income	very high/ strong			☑		very low/ non-existent
Savings/stocks	very high/ strong				☑	very low/ non-existent
Degree insurance coverage	very high/ strong			☑		very low/ non-existent
Social factors						
Literacy rate	very high/ strong			☑		very low/ non-existent
Government support	very high/ strong			☑		very low/ non-existent
Family support	very high/ strong		☑			very low/ non-existent
Community support	very high/ strong			☑		very low/ non-existent
Access to public services	very high/ strong			☑		very low/ non-existent
Physical factors						
Robustness of houses	very high/ strong				☑	very low/ non-existent
Robustness of infrastructure	very high/ strong			☑		very low/ non-existent

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- ☑ substantial increase in losses
- ☐ some increase in losses
- ☐ no change
- ☐ small reduction in losses
- ☐ substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1	☐ 1
☑ 2-5	☑ 2-5
☐ 6-10	☐ 6-10
☐ 11-50	☐ 11-50
☐ > 50	☐ > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
☐ 0	☐ 0
☐ 1-10	☐ 1-10
☐ 11-50	☐ 11-50
☐ 51-100	☐ 51-100
☐ 101-200	☐ 101-200
☐ 201-500	☐ 201-500
☑ > 500	☑ > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☑ 1-20%	☑ 1-20%
☐ 21-50%	☐ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
☐ 0% (no damage)	☐ 0% (no damage)
☐ 1-20%	☐ 1-20%
☑ 21-50%	☑ 21-50%
☐ 51-80%	☐ 51-80%
☐ 80-100%	☐ 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
☐ 0 USD	☐ 0 USD
☐ 1-1000 USD	☐ 1-1000 USD
☐ 1001-5000 USD	☐ 1001-5000 USD
☐ 5001-10’000 USD	☐ 5001-10’000 USD
☐ 10’001-50’000 USD	☐ 10’001-50’000 USD
☑ 50’000-250’000 USD	☑ 50’000-250’000 USD
☐ > 250’000 USD	☐ > 250’000 USD

Duration since last disaster

- ☐ < 3 months
- ☐ 3-6 months
- ☑ 7-12 months
- ☐ 1-2 years
- ☐ 2-5 years
- ☐ 5-10 years
- ☐ > 10 years

Protection goal of SLM Approach

The approach aims at developing mechanisms for Comprehensive Agricultural Risk Management (GRAI) through along two axes:
1) "Agro-climatic Risk Management (GRAC)" with good practices in agricultural production to reduce crop losses.
2) "Financial Agricultural Risk Management (GRAF)" by developing financial mechanisms for risk transfer (micro-insurance) to compensate for the economic damages to the producers overrun in their prevention, preparedness and response measures.
The interventions mainly aim at protecting productive goods of local farmers – plants, harvest, fields, soil fertility -from losses of frequent natural disaster events, mainly hail, frost, drought, extreme temperature.

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of esp. vulnerable	decreased	☐☐☐☐☐☑☐	increased
Early warning	decreased	☐☐☐☐☐☐☑	increased

Economic goods (on-site)

Safety of water stocks	decreased	☐☐☐☐☐☑☐	increased
Safety of seed/animal stocks	decreased	☐☐☐☐☐☑☐	increased
Safety of land assets	decreased	☐☐☐☐☐☑☐	increased

Off-site impacts

None



Authorities of the Risk Management Units in the Aymaras Sin Frontera Association of Municipalities, being sworn into office (PRRD).

Creating municipal risk management units (UGR) with a participatory approach (Plurinational State of Bolivia)

Procesos participativos en la creación de Unidades de Gestión de Riesgo (UGRs) municipales

DESCRIPTION

This approach is the result of inter-institutional cooperation carried out through the commitment of many stakeholders at different decision-making levels to manage disaster risks. UGRs (Risk Management Units) are created to institutionalise risk management and, being underpinned by participatory action, to ensure ownership and sustainability of the process.

The approach is based on the institutionalisation of risk governance by creating municipal Risk Management Units to manage risks in rural municipalities and to provide a method of collective action with the full participation of local stakeholders.

The steps followed for implementation are: a) discussions and awareness raising about the issue; b) participatory creation of instruments such as risk maps; c) demonstration projects; and d) creation of Risk Management Units with established roles. The process also includes sensitisation of mayors on the importance of creating institutionalisation. Training workshops were carried out for this purpose and municipal councils were involved and trained about the need to manage these actions through the Risk Management Unit. Users appreciate the broad participation in this process as well as joint discussions of its scope, and particularly the value of having a unit that will manage risk and influence planning.

LOCATION



Location: Municipios de Curahuara de Carangas; San Pedro de Totora; Belen de Andamarca; Corque, Altiplano, Departamento de Oruro, Plurinational State of Bolivia

Geo-reference of selected sites
- -68.15369, -18.92707

Initiation date: 2011

Year of termination: 2013

Type of Approach
- traditional/ indigenous
- recent local initiative/ innovative
- ✓ project/ programme based

Mancomunidad de Municipios Aymaras Sin Fronteras

HELVETAS Swiss Intercooperation



Authorities of the Risk Management Units in the Aymaras Sin Fronteras Association (PRRD).



UGR office in the Municipality of Corque, run by Carmen Acarapi, a young engineer (PRRD).

APPROACH AIMS AND ENABLING ENVIRONMENT

Main aims/ objectives of the approach

Institutionalisation of risk management in municipalities throughout the region by building on demonstration experiences in reduction of disaster risks and adaptation to climate change, including the creation of risk maps, capacity building and setting up early warning systems.

Set up Risk Management Units with the full participation of local and national institutions, within the established legal framework.

Conditions enabling the implementation of the Technology/ ies applied under the Approach

- **social/ cultural/ religious norms and values:** Local indigenous authorities and institutions related to the issue have participated since the beginning; this helps in developing the approach.
- **availability/ access to financial resources and services:** Allocation of resources for demonstration actions greatly helps people to understand the importance of managing disaster risks.
- **institutional setting:** If institutions leading the process are aware of the importance of the issue, this significantly helps with its implementation.
- **collaboration/ coordination of actors:** The processes are created and facilitated by involving international cooperation as well as diverse institutions – local, municipal, regional and national – in the process.
- **legal framework (land tenure, land and water use rights):** The legal framework on which the process was built helped establish powerful impact and political advocacy.
- **policies:** The process is strongly facilitated by the current national policies to integrate risk management and adaptation to climate change in the subnational institutional structure: it is of utmost importance to have policy support for the process. The Vice-Ministry of Rural Development and Agriculture supported efforts to strengthen institutionalisation by responding to initiatives within the sector related to agricultural early warning alerts. This generated internal debate and promoted the participation of different stakeholders, as well as internalising the need to work towards reducing disaster risks in municipal planning. The Vice-Ministry for Civil Defence also promoted the enforcement of corresponding policies and the creation of the Risk Management Units.
- **knowledge about SLM, access to technical support:** Generating processes to build capacities helps in better understanding of the issues and facilitates support for institutional processes.

Conditions hindering the implementation of the Technology/ ies applied under the Approach

- **knowledge about SLM, access to technical support:** The lack of information on the topic and the lack of technical support hinders the process. In this specific case, it was necessary to generate knowledge about the issue from the bottom up, since the technicians and authorities in the area were not familiar with risk management, or ways of implementing the institutionalisation. For example, they were not familiar with their roles and functions, or with procedures they could use to make and use risk maps.

PARTICIPATION AND ROLES OF STAKEHOLDERS INVOLVED

Stakeholders involved in the Approach and their roles

- **local land users/ local communities (indigenous authorities representing land users in the area):** Participation in training, information and awareness raising meetings.
- **NGO (HELVETAS Swiss Intercooperation with PRRD– Project for the Reduction of Disaster Risks – The national NGO Promoción a la Sustentabilidad y Conocimientos Compartidos PROSUCO Asociación Promoción de la Sustentabilidad y Conocimientos Compartidos):** Capacity development, awareness raising workshops, use of methodologies to reduce the risk of disasters.
- **local government (Municipalities of the Aymaras Sin Fronteras Association):** Active role in the process, at the level where people are trained and where influence can further strengthen risk management in the municipality. Coordinators of the tasks referred to development of instruments and bringing together participating local and regional organisations.
- **national government (planners, decision-makers) (Vice Ministry for Rural Development and Agriculture, Vice Ministry for Civil Defence):** Stakeholders are motivated and committed to help create institutionalisation to manage disaster risks, particularly in the agricultural sector.
- **international organisation (Swiss Cooperation in Bolivia (COSUDE) FAO):** Funding for the programme for Reduction of Disaster Risks (COSUDE), funding for meteorological stations (FAO).

Involvement of local land users/ local communities in the different phases of the Approach

	none	passive	external support	interactive	self-mobilisation
initiation/ motivation				✓	
planning				✓	
implementation				✓	
monitoring/ evaluation				✓	

Specify who was involved and describe activities

Local indigenous authorities were involved in the process together with municipal governments in the region. They participated in the full process, and discussions on all themes. They also participated in learning processes.

Municipalities played an important role, because the extreme climate events in the area generate significant economic losses.

The municipalities and the Vice-Ministry for Civil Defence and the Vice-Ministry for Rural Development and Agriculture were involved in the process of creating the Municipal Risk Management Units.

Municipalities and national institutions followed the process through to its conclusion.

Flow chart

The flowchart shows the process, and highlights a series of actions that determine its success.

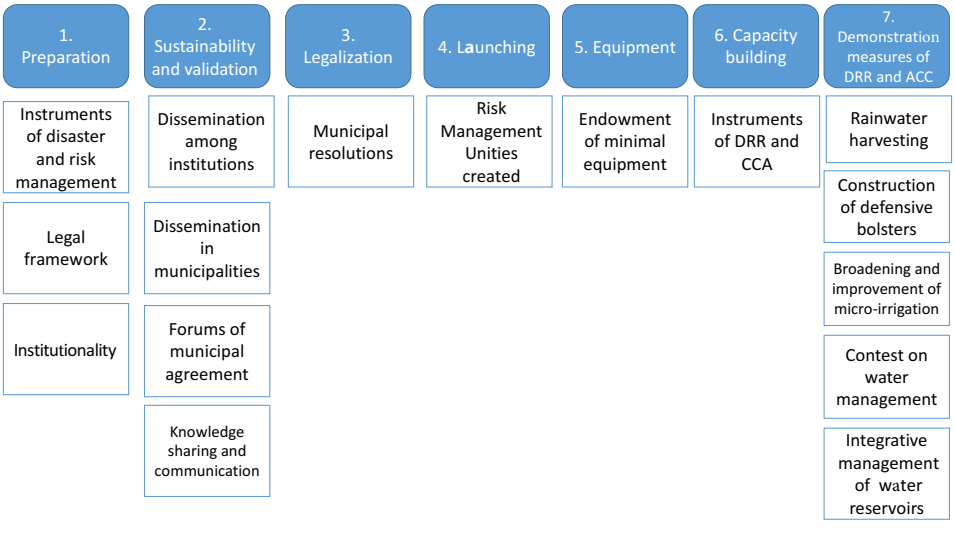


Figure: Consuelo Aranda/Oscar Paz

Decision-making on the selection of SLM Technology

Decisions were taken by

- land users alone (self-initiative)
- mainly land users, supported by SLM specialists
- ✓ all relevant actors, as part of a participatory approach
- mainly SLM specialists, following consultation with land users
- SLM specialists alone
- politicians/ leaders

Decisions were made based on

- evaluation of well-documented SLM knowledge (evidence-based decision-making)
- research findings
- ✓ personal experience and opinions (undocumented)

TECHNICAL SUPPORT, CAPACITY BUILDING, AND KNOWLEDGE MANAGEMENT

The following activities or services have been part of the approach

- ☑ Capacity building/ training
- ☑ Advisory service
- ☑ Institution strengthening (organisational development)
- ☑ Monitoring and evaluation
- ☐ Research

Capacity building/ training

Training was provided to the following stakeholders

- ☐ land users
- ☐ field staff/ advisers

Form of training

- ☐ on-the-job
- ☐ farmer-to-farmer
- ☑ demonstration areas
- ☑ public meetings
- ☑ courses

Subjects covered

- Implementation of demonstration risk management projects Training in the participatory creation of risk maps.
- Discussions about the importance of having early alert systems
- Discussions regarding the importance of including risk management in municipal planning and budget.
- Discussions on the need to have Risk Management Units.

Advisory service

Advisory service was provided

- ☐ on land users' fields
- ☑ at permanent centres

Comment: Through the Risk Management Unit, the municipality provides an assessment of the issue. The assessment includes information on potential climate events, problems these can cause in production and the course of action institutions can take in case of emergencies.

Institution strengthening

Institutions have been strengthened/ established

- ☐ no
- ☐ yes, a little
- ☐ yes, moderately
- ☑ yes, greatly

at the following level

- ☑ local
- ☐ regional
- ☐ national

Describe institution, roles and responsibilities, members, etc.

Municipalities were the key institutions to be strengthened in this process. They received instruments for risk management, such as risk maps and an Early Warning System. Their staff was trained on on risk management and the according entity (UGR) was created in order to institutionalise disaster risk management.

Type of support

- ☑ financial
- ☑ capacity building/ training
- ☐ equipment

Further details

Financial support was required to implement demonstration projects that served as a local counterpart contribution. Most of the support provided through workshops helped to generate and develop capacities.

FINANCING AND EXTERNAL MATERIAL SUPPORT

Annual budget in USD for the SLM component

- ☐ < 2000
- ☐ 2000-10000
- ☑ 10000-100000
- ☐ 100000-1,000000
- ☐ > 1000000

Major donor: Swiss Cooperation in Bolivia provided resources while the beneficiaries of the Association of Municipalities Aymaras sin Frontera provided counterpart contributions.

Precise annual budget: n.a.

The following services or incentives have been provided to land users

- ☑ Financial/ material support provided to land users
- ☑ Subsidies for specific inputs
- ☐ Credit
- ☑ Other incentives or instruments

Financial/ material support provided to land users

A series of demonstration works were funded, such as water harvesting systems and reservoirs. The Disaster Risk Reduction Programme and the municipalities involved paid for the reservoirs together. The programme provided the required funds for all the machinery required for the local water harvesting systems. The counterpart contribution consisted of labour provision.

Subsidies for specific inputs (including labour)

Labour by land users was

- ☑ voluntary
- ☐ food-for-work
- ☐ paid in cash
- ☐ rewarded with other material support

	partly financed	fully financed
labours	☑	☐

The beneficiaries of the project provided labour to install storage tanks for harvesting rainwater and build the pedestals on which the tanks were set. The beneficiaries provided untrained labour that finished the water collecting systems.

Other incentives or instruments
Existing policies requiring municipalities for managing disaster risks served as the basis of the process. For this purpose, the Vice Ministry for Rural Development and Agriculture and the Vice Ministry for Civil Defence participated in raising awareness about existing policies. Though these entities did not provide any funding, they did support the process. As a result of these and other experiences, the Vice Ministry for Civil Defence published a manual about creating municipal risk management units, with the support of the Disaster Risk Reduction Program.

IMPACT ANALYSIS AND CONCLUDING STATEMENTS

Impacts of the Approach

	No	Yes, little	Yes, moderately	Yes greatly
Did the Approach enable evidence-based decision-making? *The municipal Risk Management Units that were created now play an important role in risk management.*				✓
Did the Approach help land users to implement and maintain SLM Technologies? *Municipal technicians learned about the relevant issues and improved their skills in interpreting risk maps, in understanding the roles of risk units, the ways in which the diverse elements and actors in the projects interact and the actions that need to be taken at different stages of emergencies.*				✓
Did the Approach improve coordination and cost-effective implementation of SLM? *Municipalities and social organisations involved were empowered by learning about the value and relevance of risk management and were actively involved in creating Risk Management Units.*				✓
Did the Approach mobilise/ improve access to financial resources for SLM implementation? *The importance of reducing disaster risks was highlighted, especially in regard to prevention measures, and this, in turn, empowered the stakeholders.*			✓	

Main motivation of land users to implement SLM

- increased production
- increased profit(ability), improved cost-benefit-ratio
- reduced land degradation
- ✓ reduced risk of disasters
- reduced workload
- payments/ subsidies
- rules and regulations (fines)/ enforcement
- prestige, social pressure/ social cohesion
- affiliation to movement/ project/ group/ networks
- environmental consciousness
- customs and beliefs, morals
- ✓ enhanced SLM knowledge and skills
- aesthetic improvement
- conflict mitigation

Sustainability of Approach activities
Can the land users sustain what had been implemented through the Approach (without external support)?

- no
- ✓ yes
- uncertain

Comment: The UGRs can help reducing the risks of disasters.

CONCLUSIONS AND LESSONS LEARNT

Strengths

Land user's view
- Municipal institutions have assumed their role in risk management and included Risk Management Units in their policy framework.

Key resource person's view
- The approach strengthened governability of Disaster Risk Reduction and Climate Change Adaptation through planning actions at the level of municipalities.

Weaknesses/ disadvantages/ risks → *how to overcome*

Land user's view
- The process is weakened when new politicians take office or municipal technicians are replaced with new ones. → *Ensure the sustainability of the process through institutionalisation, by continuing the enhancement of capacities and involvement of more institutions in the process.*

Key resource person's view
- The economic context is important; when municipal budgets are reduced, Disaster Risk Reduction measures are rarely considered as priorities and, as a result, funds for these are cut. → *To ensure advocacy in the different institutions, those working specifically on social control, to lobby on the importance of funding.*

REFERENCES

Compiler: Oscar Paz - oscar.paz@helvetas.org
Resource persons: Oscar Paz (oscar.paz@helvetas.org) - Technician of the region
Full description in the WOCAT database: https://qcat.wocat.net/en/wocat/approaches/view/approaches_692
Documentation was facilitated by: HELVETAS (Swiss Intercooperation)

Key references

Procesos participativos en la creación e implementación de UGRs municipales. Mancomunidad Aymaras sin fronteras, PRRD, 2014: http://www.rrd.com.bo/wp-content/uploads/2015/publi_fases/fase_03/34ASF01.pdf

Links to relevant information which is available online

Reducción del riesgo de desastres – Gobernanza del riesgo, colecion de documentos de capitalisacion y herramients, Helvetas, Cosude: www.rrd.com.bo Manual de Organización y Funcionamiento la Unidad de Gestión del Riesgo (UGR), VIDECI, PRRD, 2013: http://www.rrd.com.bo/wp- content/uploads/2015/publi_fases/fase_03/10manual_iugr.pdf

Additional DRR information

RISK PROFILE: HAZARDS, VULNERABILITY, DAMAGES AND LOSSES

Hazards relevant to Approach location

	on-going/ gradual	recurrence < 2 years	10 – 30 years	30 -100 years	recurrence > 100 years
Natural hazards					
Flood			✓		
Landslide		✓			
Extreme Temperature		✓			
Drought		✓			
Biological hazards					
None					
Man-made hazards					
Pollution	✓				

Vulnerability – capacity profile of the site before the Approach was applied

Exposure						
of people	very high/ strong		✓			very low/ non-existent
of community land	very high/ strong		✓			very low/ non-existent
Economic factors						
Access to markets	very high/ strong				✓	very low/ non-existent
Income	very high/ strong				✓	very low/ non-existent
Diversification of income	very high/ strong				✓	very low/ non-existent
Savings/stocks	very high/ strong				✓	very low/ non-existent
Social factors						
Literacy rate	very high/ strong			✓		very low/ non-existent
Government support	very high/ strong			✓		very low/ non-existent
Family support	very high/ strong		✓			very low/ non-existent
Community support	very high/ strong			✓		very low/ non-existent
Access to public services	very high/ strong			✓		very low/ non-existent
Physical factors						
Robustness of houses	very high/ strong				✓	very low/ non-existent
Robustness of infrastructure	very high/ strong			✓		very low/ non-existent

Damage and losses situation at the Approach location

Change in losses in the last 10 years

- [x] substantial increase in losses
- [ ] some increase in losses
- [ ] no change
- [ ] small reduction in losses
- [ ] substantial reduction in losses

People killed by/ missed after disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1	[ ] 1
[x] 2-5	[x] 2-5
[ ] 6-10	[ ] 6-10
[ ] 11-50	[ ] 11-50
[ ] > 50	[ ] > 50

People directly affected by disasters

over the last 5 years	over the last 15 years
[ ] 0	[ ] 0
[ ] 1-10	[ ] 1-10
[ ] 11-50	[ ] 11-50
[ ] 51-100	[ ] 51-100
[ ] 101-200	[ ] 101-200
[ ] 201-500	[ ] 201-500
[x] > 500	[x] > 500

% of land destroyed by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[x] 1-20%	[x] 1-20%
[ ] 21-50%	[ ] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

% of land affected by disasters

over the last 5 years	over the last 15 years
[ ] 0% (no damage)	[ ] 0% (no damage)
[ ] 1-20%	[ ] 1-20%
[x] 21-50%	[x] 21-50%
[ ] 51-80%	[ ] 51-80%
[ ] 80-100%	[ ] 80-100%

Damage sum (in USD) caused by disasters

over the last 5 years	over the last 15 years
[ ] 0 USD	[ ] 0 USD
[ ] 1-1000 USD	[ ] 1-1000 USD
[ ] 1001-5000 USD	[ ] 1001-5000 USD
[ ] 5001-10’000 USD	[ ] 5001-10’000 USD
[ ] 10’001-50’000 USD	[ ] 10’001-50’000 USD
[x] 50’000-250’000 USD	[x] 50’000-250’000 USD
[ ] > 250’000 USD	[ ] > 250’000 USD

Duration since last disaster

- [ ] < 3 months
- [ ] 3-6 months
- [ ] 7-12 months
- [x] 1-2 years
- [ ] 2-5 years
- [ ] 5-10 years
- [ ] > 10 years

Protection goal of SLM Approach

Create institutional conditions for governance of risk management, strengthening institutionality and availability of resources for prevention and emergency response at the municipal level. In addition, provide the municipalities with mechanisms and instruments that serve to plan and show field experiences for DRR

IMPACTS

Additional benefits of the Approach

Safety (on-site)

Safety of people	decreased	increased
Evacuation and shelter	decreased	increased
Safety of esp. vulnerable	decreased	increased
Early warning	decreased	increased
Safety of key documents	decreased	increased

Economic goods (on-site)

Safety of individual housing	decreased	increased
Safety of water stocks	decreased	increased
Safety of seed/animal stocks	decreased	increased
Safety of land assets	decreased	increased
Safety of communal assets	decreased	increased

Off-site impacts

None

Annex



N. Harari, Tajikistan – Well-managed family orchard in a degraded landscape providing fruit, grass for animals and wood.



Annex 1: Abbreviations and Acronyms

CBD	Convention on Biological Diversity
CCA	Climate Change Adaptation
CCM	Climate Change Mitigation
CDE	Centre for Development and Environment
CRED	Centre for Research on the Epidemiology of Disasters, Université Catholique de Louvain, Brussels, Belgium
CSA	Climate-Smart Agriculture
CSO	Civil Society Organisation
DRR	Disaster Risk Reduction
IPCC	Intergovernmental Panel on Climate Change
IRM	Integrated Risk Management
LDN	Land Degradation Neutrality
MEA	Millennium Ecosystem Assessment
NGO	Non-governmental organisations
PEDRR	Partnership for Environment and Disaster Risk Reduction
SDGs	Sustainable Development Goals
SFDRR	Sendai Framework for Disaster Risk Reduction
SLM	Sustainable Land Management
UN	United Nations
UNCCD	United Nations Convention to Combat Desertification
UNFCCC	United Nations Framework Convention on Climate Change
UNISDR	United Nations Office for Disaster Risk Reduction
WOCAT	World Overview of Conservation Approaches and Technologies

Annex 2: Overview of assessment tools for targeted DRR projects and DRR mainstreaming

Participatory Risk Assessment Tools			
Name	**Organization**	**Description**	**Link**
Participatory Assessment of Climate and Disaster Risks (PACDR) First published: 2009 Latest review: 2017 Languages available: English, French, Spanish, Portuguese, Khmer, Filipino, Indonesian	Bread for All & HEKS	Participatory and simple tool to facilitate the assessment of climate and disaster hazards and the impact of development projects on adaptive capacities and Greenhouse Gas emissions	https://brotfueralle.ch/content/uploads/2014/04/PACDR_E_Ver7-April-2017.pdf
Community-based Risk Screening Tool – Adaptation & Livelihoods (CRiSTAL) First published: 2007 Latest review: 2012 Languages available English, Spanish and French.	IISD, HELVETAS Swiss Intercooperation, IUCN & SEI	CRiSTAL is a project-planning tool that helps users design interventions supporting Disaster Risk Reduction and Climate Change Adaptation at the community level.	https://www.iisd.org/cristaltool/
Community-based Disaster Risk Reduction planning tool, Bangladesh First published: 2010 Latest review: 2010 Languages available: English	HELVETAS Swiss Intercooperation	Local level risk assessment of natural hazards and development of action plans for reducing the impact of disasters	https://assets.helvetas.ch/downloads/community_20based_20disaster_20risk_20reduction_20__202010.pdf
Community-based Disaster Risk Reduction planning tool, Bangladesh First published: 2010 Latest review: 2010 Languages available: English	HELVETAS Swiss Intercooperation	Local level risk assessment of natural hazards and development of action plans for reducing the impact of disasters	https://assets.helvetas.ch/downloads/community_20based_20disaster_20risk_20reduction_20__202010.pdf
IFRC Vulnerability and Capacity Assessment toolkit First published: 2006 Latest review: currently undergoing review Languages available: English, Spanish, French, Arabic	International Federation of Red Cross and Red Crescent (IFRC)	Tool that uses various participatory methods to gauge people's exposure to and capacity to resist natural hazards, enabling to identify local priorities appropriate action to reduce disaster risk and assists in the design and development of programmes. Includes a repository with documented VCA reports for information and future reference.	http://www.ifrc.org/vca
Community-based Disaster Risk Reduction (CBDRR) Practitioners Guidelines First published: 2013 Latest review: 2013 Languages available: English	Global Disaster Preparedness Center (International Red Cross Network)	A step-by-step guidance for CBDRR including tools and methodologies and good practices.	CBDRR Practitioner' Guidelines
Building Resilience: Community-managed DRR (CMDRR) First published: 2007 Latest review: 2013 Languages available: English, Spanish, French, Bahasa, Bangla, Tamil, Hindi	International Institute of Rural Reconstruction (IIRR) & Cordaid	A manual designed primarily for trainers and practitioners, comprising three modules and providing a hands-on participatory tool for DRR, including considerations of Climate Change Adaptation and ecosystems management.	https://www.cordaid.org/en/publications/building-resilient-communities-training-manual-community-managed-disaster-risk-reduction/

Cost-benefit assessments			
DRR Cost-efficiency considerations (CBA), Tajikistan Last update: 2009	CARITAS Switzerland, CARITAS Luxembourg	Hands-on guide to assess hazards and vulnerability and to determine their cost-efficiency to be used as decision-support system for local governments, mostly for structural measures.	https://www.caritas.ch/fileadmin/user_upload/Caritas_Schweiz/data/site/was-wir-tun/engagement-weltweit/country-programme/tadschikistan/2009_Guide_Cost_Efficiency_Considerations.pdf
Análisis costo-beneficio First published: 2017 Languages available: Spanish, English (2018)	Swiss Red Cross	Step-by-step guide for cost-benefit analysis, on basis of Swiss Tool "EconoMe", simplified / adapted to the context of Latin America	Can be obtained upon request from the Swiss Red Cross (info@redcross.ch)
Community-Based Disaster Risk Reduction and Adaptation Planning: Tools for Prioritizing Potential Solutions First published: 2015 Languages available: English	IFRC, ISET	Practical and concise guide for reviewing and prioritizing solutions identified through participatory community-based assessments while taking economic efficiency into consideration.	https://reliefweb.int/report/world/community-based-disaster-risk-reduction-and-adaptation-planning-tools-prioritizing
Not DRR-specific: **How-to-Do Note on Cost/Benefit Analysis and other Economic/Financial Assessments of Results)** Last update: 2011	Swiss Agency for Development and Cooperation	Provides an overview on economic and financial aspects that should be integrated increasingly into the results analysis and reporting	https://www.shareweb.ch/site/EI/Documents/PSD/Tools/Resource_Box/Project%20Review%20and%20Evaluation/Reviews%20and%20evaluations/SDC%20-%20How%20to%20Note%20-%20Cost%20Benefit%20Analysis%20-%202011.pdf
Tools for Mainstreaming DRR			
CEDRIG light Cross-sectoral	Swiss Agency for Development and Cooperation	Supports reflection on whether projects, programmes or strategies are at risk from climate change, environmental degradation and natural hazards. Modules: 1) CEDRIG light (Screening) 2) CEDRIG strategic 3) CEDRIG operational	https://www.cedrig.org/
SDC-CARE Sector: Water/WASH	Swiss Agency	A thorough and well illustrated guidance on hazards, their impact on WASH infrastructure and how they can be mitigated, based on the experience of the SANBASUR project in Peru	Mitigation Guidance for Water and Rural Sanitation
Water User Master Plan (WUMP) Sector: Water / WASH	HELVETAS Swiss Intercooperation	WASH-tool with DRR elements in analysis-part	https://assets.helvetas.org/downloads/13_waterusemasterplan_wump_blau_final_engl_a4_portrait.pdf
Sustainability Assessment Tool for Water Supply and Sanitation Programmes	aguasan	The « Blue Diamond » refers to fields of interventions for integrated water resource management. During the Aguasan workshop «DRR in WASH 2015» it was complemented by guiding questions related to DRR, structured along the 6 dimensions: social, economic, environmental, institutional, technological and knowledge	https://www.shareweb.ch/site/DRR/Documents/Related%20Sectors/Integrated%20Water%20Resources%20Management/Blue%20Diamond-withDRR-Aguasan2015.zip Add also: http://www.aguasan.ch/ws2015/AGUASAN_Workshop_2015_Briefing_Note.pdf
Guideline - Assessing Climate Risks and Vulnerabilities in Market Systems Sector: agriculture / Market Systems	HELVETAS Swiss Intercooperation	Guideline on assessing climate risks and vulnerabilities in market systems to analyse the vulnerabilities of value chains/subsectors to climate change/disaster risks and to identify possible adaptation and DRR options for climate and disaster resilient value chains/subsectors.	https://assets.helvetas.org/downloads/guideline_climate_21july_2017_final.pdf

where people and their land are safer

A Compendium of Good Practices in Disaster Risk Reduction

Any effort to improve the resilience of the land
will reduce the vulnerability of the people.



